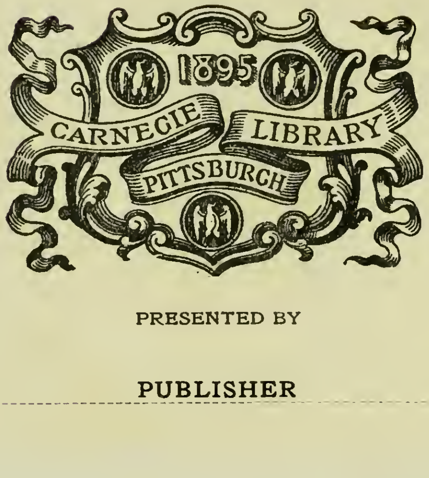

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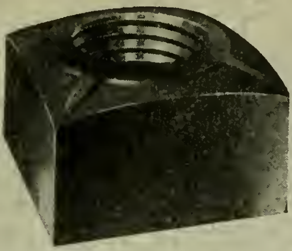

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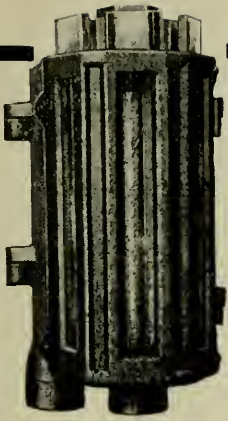

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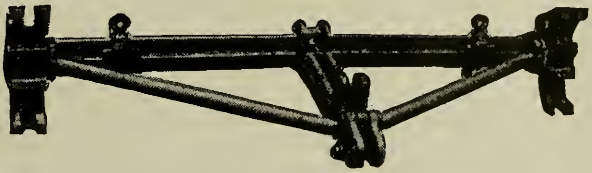

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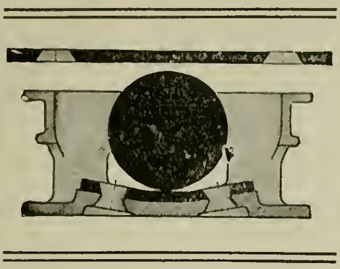

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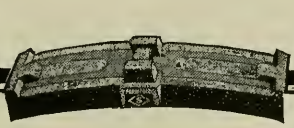

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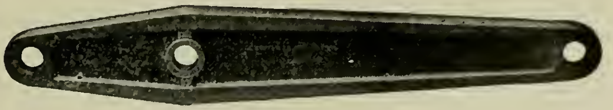

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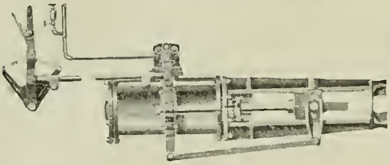

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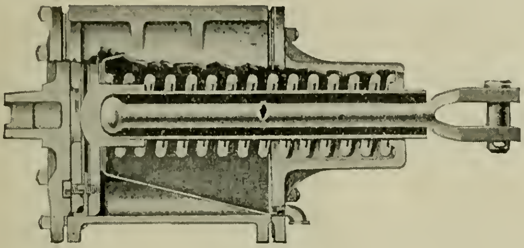

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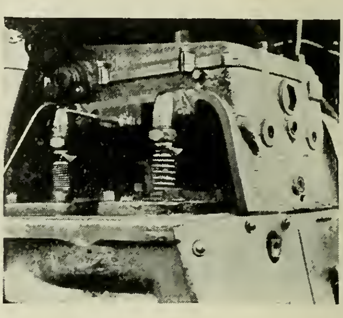

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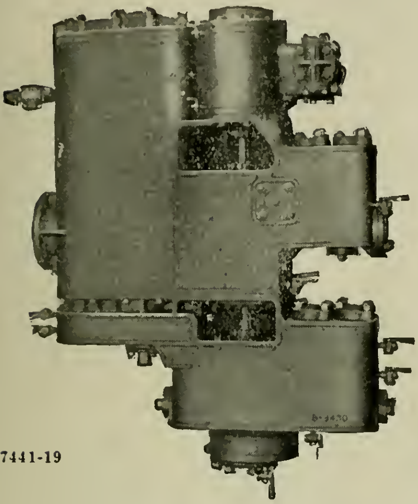

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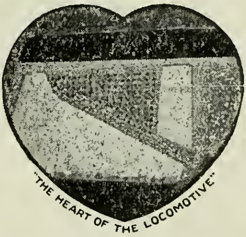

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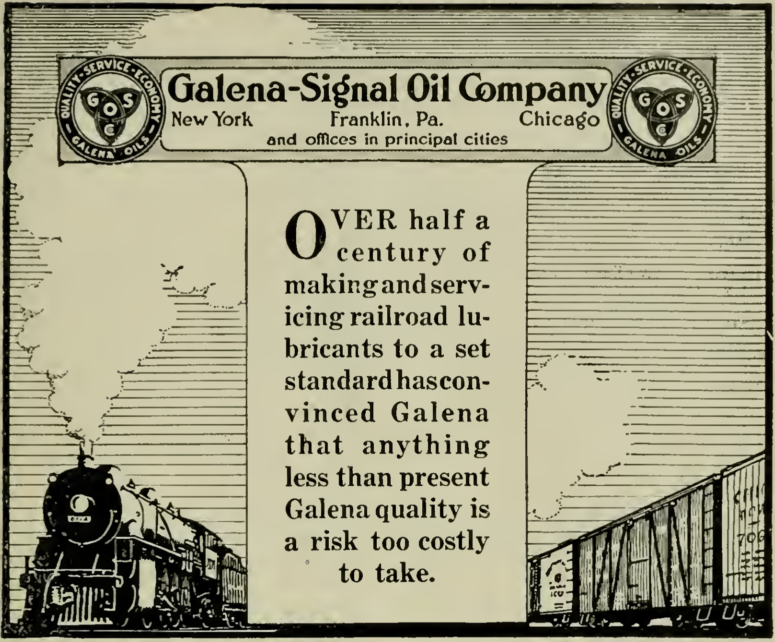

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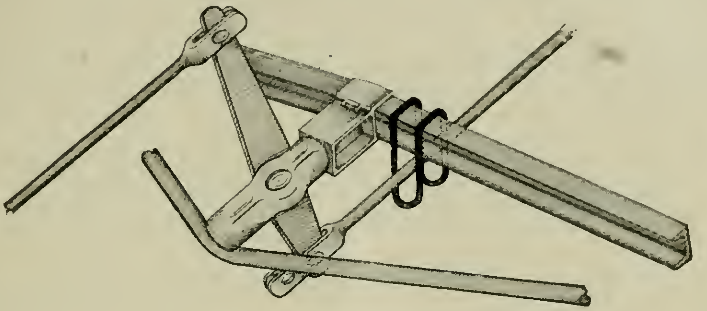

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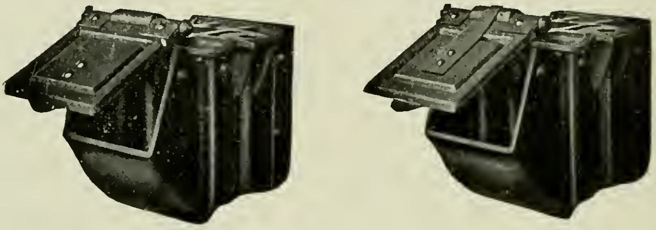

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GEORGE F. LAURENT, Asst. Supt., Fort Pitt Malleable Iron Co., Pittsburgh, Pa.
A. B. WHITE, Superintendent, B. R. & P. Ry., Punxsutawney, Pa.
F. I. SNYDER, Vice Pres. & Gen. Mgr., B. & L. E. R. R., Pittsburgh, Pa.

Past Presidents

*J. H. McCONNELL	October, 1901, to October, 1903
L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
*J. A. SPIELMANN	November, 1918, to October, 1919
H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
NOVEMBER 22, 1928

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

MEMBERS

Allen, E. J.
Altsman, W. H.
Ashton, William A.
Balzer, C. E.
Bates, Harold W.
Bevan, P. A.
Blair, John R.
Brinkhoff, W. H.
Campbell, C. A.
Campbell, J. E.
Campbell, J. T.
Carson, John
Christy, F. X.
Conway, J. D.
Coulter, A. F.
Cunningham, J. L.
Dalzell, W. E.
Davis, Charles S.
Dempsey, P. W.
Devans, E. J.
Durkin, James E.
Edwards, C. H.
Eichhorn, T. F.
Emery, E.
En Dean, J. F.
Fisher, John J.
Flinn, R. H.
Fults, J. H.
Gardner, K. C.
Geisler, Joseph J.
Gorman, P. F.
Haller, Nelson M.
Hansen, William C.
Hastings, Walter S.
Hilstrom, A. V.
Holmes, E. H.
Hoover, J. W.
Horner, William
Howard, L. F.
Kelly, L. J.
Laurent, George F.
Laurent, Joseph A.
Leckey, Ralph F.
Loeffler, George O.
Lynn, Samuel
Millar, C. W.
Miller, J.
Milliken, Col. James
Mitchell, F. K.
Mitchell, W. S.
Morgan, A. L.
Morris, J. H.
Myers, W. H.
McAbee, W. S.
McIntyre, R. C.
McKinley, Archie
McNamee, W.
McNelty, A. P.
Nelson, W. M.
Noble, Jesse A.
O'Sullivan, John J.
Painter, Joseph
Paisley, F. R.
Passmore, H. E.
Ralston, J. A.
Rauschart, E. A.
Reddick, Warren E.
Redding, P. E.
Reeve, George
Reifsnyder, J. W.
Ritts, W. H.
Rowles, L. L.
Rushneck, G. L.
Sattley, E. C.
Schaacke, William
Schultz, C. H.
Seley, C. A.
Semethy, J.
Severn, A. B.
Sharp, H. W.
Shelton, F. M.
Sheridan, T. F.
Showalter, Joseph
Simons, Philip
Skuce, C. G.
Smith, M. A.

Snodgrass, Thomas R.
Snyder, J. A.
Spinning, Charles F.
Stevens, R. R.
Stoecker, J. P.
Stoffregen, Louis E.
Stucki, A.
Sutherland, L.
Thompson, F. J.
Van Blarcom, W. C.
Vandivort, R. E.
Van Ryn, William
Vollmer, Karl L.
Weston, A. P.
White, A. B.
Wood, E. H.
Wright, John B.
Wright, O. L.
Young, F. C.

VISITORS

Benson, A. J.
Bone, H. L.
Boore, J. P.
Borg, H. H.
Brass, C. F.
Case, J. D.
Chappell, Thomas V.
Dahlinger, A. C.
Darrah, William H.
Davis, William B.
Devine, William J.
Duff, S. B.
Eaches, Charles G.
Evans, David F.
Findlater, S.
Fisher, Earl H.
Fix, Fred
Flatley, William J.
Forrester, J. B.
Gerwig, H. C.
Gray, R. H.
Hardisty, E. C.
Inail, Fred J.
Jones, W. D.
Kennedy, Thomas F.
King, W. R.
Kinney, Thomas F.
Kusserow, Fred W.
Lewis, S. B.
Mason, J. R.
McNiff, G. P.
O'Connor, W. F.
Orth, R. P.
Passmore, H. E., Jr.
Roney, H. E.
Rowles, Stewart
Rush, Benjamin H.
Schmitt, Raymond F.
Schrontz, S. B.
Selkirk, W. M.
Sill, Harry, Jr.
Sleeman, E. C.
Smith, Simon B.
Stitt, T. G.
Stossell, L. S.
Timmins, J. B.
Trautman, Harry G.
Ward, George T.
Wilson, B. H.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with as they have appeared in printed form and been distributed to the members.

The Secretary read the follwoing list of applications for membership:

Averman, E. J., Vice President and Treasurer, General Bronze Company, 6020 Station Street, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Canterbury, L. E., Telegraph Operator, P. & L. E. R. R., Box 86, Newell, Pa. Recommended by S. A. Damore.

Diehl, A. N., Vice President, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Dixon, T. L., Foreman Mechanical Department, Union Railroad, 855 Rebecca Avenue, Wilkinsburg, Pa. Recommended by R. C. McIntyre.

Evans, David F., Representative, The Duff Manufacturing Company, N. S., Pittsburgh, Pa. Recommended by E. A. Rauschart.

Fisher, Earl H., Sales Engineer, The Wine Railway Appliance Company, Toledo, Ohio. Recommended by E. A. Rauschart.

Fowler, W. E., General Superintendent, Montour Railroad, Coraopolis, Pa. Recommended by E. A. Rauschart.

Gaffney, Thomas H., Roadmaster, Montour Railroad, State Avenue, Coraopolis, Pa. Recommended by E. A. Rauschart.

Guy, Frank E., Assistant Traffic Manager, Universal Portland Cement Company, Frick Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Hamilton, W. H., Superintendent Roadway and Structures, Montour Railroad, Coraopolis, Pa. Recommended by E. A. Rauschart.

Harper, G. C., Superintendent Transportation, Montour Railroad, Vaner Avenue, Coraopolis, Pa. Recommended by E. A. Rauschart.

Kepler, G. W., Secretary and Treasurer, B. & L. E. R. R. Co., Union Trust Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Kinney, Thomas F., Assistant Foreman, Department "U", Westinghouse Air Brake Company, 233 Welsh Avenue, Wilmerding, Pa. Recommended by L. L. Rowles.

Kleinhans, L., General Manager, Equipment Sales & Rentals Company, Oliver Building, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Knight, H. C., District Sales Manager, Industrial Brownhoist Corporation, Oliver Building, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Landsperger, Elmer C., General Yard Master, P. & L. E. R. R., 209 Monongahela Avenue, Glassport, Pa. Recommended by J. E. Hughes.

Milliken, C. C., Traffic Despatcher, Universal Portland Cement Company, 517 Frick Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Mulvey, John L., Traffic Manager, Hubbard & Company, 6301 Butler Street, Pittsburgh, Pa. Recommended by J. T. Campbell.

McKalip, James C., General Auditor, B. & L. E. R. R. Co., P. O. Box 456, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

McPherson, A. R., Train Master, Montour Railroad, Ridge Avenue, Coraopolis, Pa. Recommended by E. A. Rauschart.

Nagel, James, Assistant to President, Montour Railroad, Ferree Street, Coraopolis, Pa. Recommended by E. A. Rauschart.

Passmore, H. E., Jr., National Tube Company, Frick Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Randolph, W. E., Chief Clerk, Traffic Department, Universal Portland Cement Company, 521 Frick Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Sanders, George, General Foreman, Mechanical Department, Union Railroad, 565 Negley Avenue, Turtle Creek, Pa. Recommended by R. C. McIntyre.

Scott, L. M., Chief Dispatcher, Montour Railroad, Coraopolis, Pa. Recommended by E. A. Rauschart.

Scull, Joseph W., Sales Representative, Stronach Nail Company, Union Bank Building, Pittsburgh, Pa. Recommended by Col. James Milliken.

Seaman, G. W., Assistant Traffic Manager, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Shafer, J. S., Clerk, Mechanical Department, Union Railroad, 325 Franklin Avenue, Wilkinsburg, Pa. Recommended by R. C. McIntyre.

Smith, C. J., Station Employee, P. & L. E. R. R., Market Street, Elizabeth, Pa. Recommended by S. A. Damore.

Snodgrass, Thomas R., Assistant Supervisor, Monongahela Connecting Railroad, 3540 Second Avenue, Pittsburgh, Pa. Recommended by H. C. Pringle.

Trautman, Harry G., Foreman, Briggs & Turivas, R. D. No. 2, Coraopolis, Pa. Recommended by W. McNamee.

Trust, C. W., Assistant Traffic Manager, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pa. Recommended by W. S. McAbee and L. C. Bihler.

Tyrie, Robert M., R. F. of E., Montour Railroad, Maple Street, Coraopolis, Pa. Recommended by E. A. Rauschart.

PRESIDENT: These applications will be referred to the Executive Committee in accordance with our By-Laws, and upon approval by them, the gentlemen will become members without further action.

SECRETARY: Since our last meeting we have received information of the death of two of our members, W. H. Holbrook died February 22, 1928, and Egbert H. Gold died November 3, 1928.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

If there is no further business to come before the meeting, we come to the paper of the evening, which is a discussion of the Manufacture of Seamless Tubes, by Mr. H. E. Passmore, Jr., of the National Tube Company, Pittsburgh, Pa.

MR. H. E. PASSMORE, JR.: I am very sorry to say that I have contracted a cold that has robbed me of my voice, as you will notice, and therefore I will have to ask that the paper be read by Mr. Findlater who is well qualified for that duty, as he is Superintendent of the Ellwood City plant.

THE MANUFACTURE OF SEAMLESS STEEL TUBES

By H. E. PASSMORE, JR.,
National Tube Company, Pittsburgh, Pa.

The first use for iron or steel tubes was for conveying gas for lighting purposes. I am speaking now of tubes as we think of them, as there were prior to gas light, gun barrels and some other cylinders of iron used; in fact ,the first iron gas lines consisted of gun barrels screwed together, the use of gas being introduced shortly after the Napoleonic wars, when there were large quantities of musket barrels to be had for trifling sums. In later wars, some men have been accused of reversing the process and instead of using musket barrels for gas pipe, they furnished gas pipe for musket barrels. The reverse action was not as satisfactory as the original.

The men engaged in the iron and steel business were not slow in meeting the demand for pipe, and by the year 1825 the process of butt welding was invented. The methods used today in butt welding are but refinements of the original idea, which was the drawing of a piece of hot iron through a die causing the hot edges to come into contact and be fused together. The original scheme was a chain bench set close enough to a furnace so that the iron in the furnace could be grasped with a pair of tongs and the tongs connected to the chain, which pulled the piece through a die and formed the tube just about as we do it now, the chief difference being that the original inventor first formed the skelp into the tubular form before heating, whereas the practice now is to form and weld in the same operation.

These butt welded tubes answered all purposes for some time but with the advent of the steam engine and boilers for generating the steam for them, a better tube than had been heretofore produced was needed and to meet this demand the art of lap welding was developed. The first tubes made, gun barrels, were lap welded. As they were not long, this could be accomplished by inserting a mandrel inside the heated piece and welding the seam with a hand hammer or an anvil. Some manufacturers, however, used power hammers and swedges. The cost of production by this method, of course, was prohibitive. This compelled the invention of lap welding through rolls over a mandrel or plug, as we term it, and this practice was very well established quite early, as early as 1840 at least, and we find that rolls and plugs were used as early as 1817, and we are today, more than 100 years later, still experimenting with both, trying to find suitable material from which to make them and methods of using them.

All of this early development of which I have spoken transpired in England, which was at that time the center of the iron and steel business of the world, in fact the English laid the foundation for our present iron and steel era. Slow as the progress has been, yet in all these years we have gone quite a distance, nevertheless, for today we are welding, by the lap weld process, pipe with diameter as large as 30 inches, and by the hammer weld process or horn weld process up to 120 inches diameter.

The hammer weld process in case some of you are not familiar with it, is of rather recent origin and was designed for the production of large tubular shells or tubes, and is generally used for sizes larger than can be conveniently welded through rolls. In this process the sheet or skelp is formed into a tubular shape with the edges over-lapping in the same way that the skelp is prepared for roll welding. It is then mounted on a table so designed that it can be moved laterally or circumferentially. Into the tube is inserted a gas burner and an anvil, each being carried on arms long enough to reach past the center of the tube and both of which can be raised or lowered at the will of the operator. Outside the tube is carried a hammer which is directly over the anvil and another gas burner which is directly over the burner in the tube, the anvil and hammer sitting ahead or behind the burners in reference to the length of the tube. Heat is applied to a short portion of the lapped section to be welded, and when sufficiently hot, the gas is shut off and the hot portion of the tube is moved between the anvil and hammer where the weld is effected by the old method hammering on an anvil. Only short portions of the seam can be welded at a time, some 16 inches, all of which is a very slow operation.

Running concurrently with the development of the welded tube, there have been developed many methods for forming tubes with other than welded seams such as hooked, lapped, brazed, etc.—with seams that form a spiral around the tube as well as those that are parallel with its axis, but these are of little interest to us, so I will get to the subject that we are the most concerned with, the production of seamless or weldless tubes.

The first record of patents on seamless machinery were those given to the Mannesmans in 1885. Their specifications covered quite a variety of roll and disc shapes and were to be used not only for the production of tubes but also for reducing solid bars.

Mannesman in his specifications claimed to be able to produce by the use of rolls, hollow billets without the aid of any mandrel on the inside, asserting that the diameter of the hole in the billet depended on the amount of reduction and the rate of feed. He said, however, that if a smooth hole was desired, some supporting mandrel on the inside must be used. A further claim was that it was possible to produce billets partly hollow and partly solid, either by having the solid of various diameters before entering the mill, or by changing the mill setting during the operation, since the amount of reduction determined whether or not the billet would be hollow or solid. This peculiarity they thought would be valuable in the making of axles for cars, etc.

A further advantage claimed for this mill was that it placed the fibers of the steel in a spiral around the tube instead of leaving them parallel with its axis. We can substantiate this claim with reservations as to its advantageousness.

The Mannesmann Machine for piercing round billets embodies the principle of diagonal rolling, which at the time proved to be a somewhat startling innovation. This principle can be carried out in a number of different ways with rolls of different shapes, but only the manner in which it is employed at the present time will be described. The rolls used in this machine are comparatively heavy. They measure, over all, about thirty-six inches, and, in the body, or face, twenty-four inches in length, and from thirty-two to forty inches in diameter. Their diameters are varied according to the size of tubes to be made; a thirty-two-inch roll is the size most suitable for all tubes up to four and one-half inches in size, while a thirty-six-inch roll is employed for sizes between four and one-half and nine inches. Their shape resembles that of a piece cut from the middle of a very large spindle with a flat portion about one inch long at the middle. From this flat part each roll tapers toward each end at an angle of 5° to 10°. This angularity of the rolls is necessary to produce the play of forces required to effect the piercing and at the same time permit the billet to be drawn continuously through the mill. These rolls may be made of steel or other material, and are made with necks like an ordinary roll but are provided with a type of universal joint instead of wobblers. When they are placed in their housings, the lie side by side instead of one above the other, and their axes are set slightly askew and inclined, each at an angle of 6° to 12°, in opposite directions, so that the rolls cross each other at their centers. Upon the amount of this angle depends the speed with which the billet will be drawn through the mill. They can be adjusted laterally in their housings, and are set so that the distance between their rolling surfaces at the middle is a definite amount less than the diameter of the billet to be pierced. The rolls are driven by an electric motor on the entering side. The power required varies depending upon the size of the piercer. By means of a system of gears and two long spindles, the rolls are driven, both in a clockwise direction, at a speed of about 90 r.p.m. Sprays of water are provided to keep the rolls cool while in use. See Figure 1.

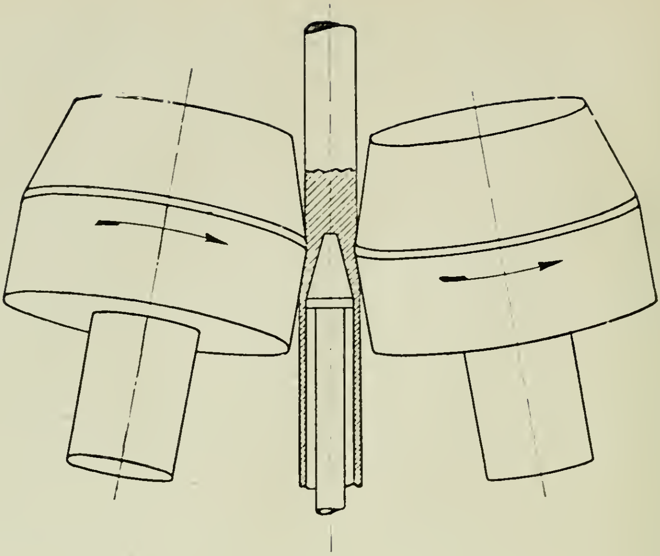

FIG. 1

The operation of piercing: Although the action of the rolls is far from being as simple, the piercing is performed apparently with as much ease as any ordinary rolling process. A round billet, of the proper length and diameter to make the size and length of tube desired, is first centered on one end to a depth of about one inch, and is then heated uniformly to the usual temperature for rolling light sections. Next, a mandrel, or plug, with a pointed nose, tapered at the proper angle and known as the piercer point, is attached to a water cooled rod designed for the purpose, and inserted between the rolls from the delivery side, so that its pointed end just passes the line where the rolls cross. With the rolls revolving at a constant speed, the heated billet, lying in a trough, is now pushed, centered end first, into the space between the rolls by means of a rod actuated by a hydraulic or compressed air cylinder. The rolls immediately grasp the billet, revolve it rapidly, and pull it slowly forward, while at the same time they draw the metal away from the center to form a hole, elongate and enlarge this hole, and force the metal over the plug and rod, which while they revolve in a thrust-block bearing at the same rate as the billet, mantain the same relative position with respect to the rolls. Less than a minute is required to perform this composite operation. When the billet issues from the mill, having been forced entirely over the mandrel, or plug, it is in the form of a thick walled tube.

somewhat rough on its surface but fairly uniform as to thickness of wall.

The action of the rolls is somewhat difficult to understand and still more difficult to explain satisfactorily. It is evident that the forward motion of the billet is caused by the inclination of the axes of the rolls. How these two rolls, by exerting pressure only on the surface of the billet, are able to force the metal over the mandrel to form a tube from a solid billet is not so readily grasped. It is to be especially noted that the mandrel is not forced through the metal, but that the rolls cause the metal to flow over and about the mandrel. To bring about this result, the rolls must first draw metal away from the center of the billet, which action forms, or tends to form, a central hole, or cavity, for the passage of the mandrel, or piercer. The truth of this statement is evident from the fact that a small, but somewhat irregular, hole may be formed in a billet without the use of the piercer point.

The principle involved in forming the cavity: Indeed, such a hole can be opened up in the center of any solid cylindrically shaped plastic body by rolling it between, even, two flat surfaces. Steel workers, particularly hammerman, are familiar with the fact that, if a piece of steel in the form of a round be pressed

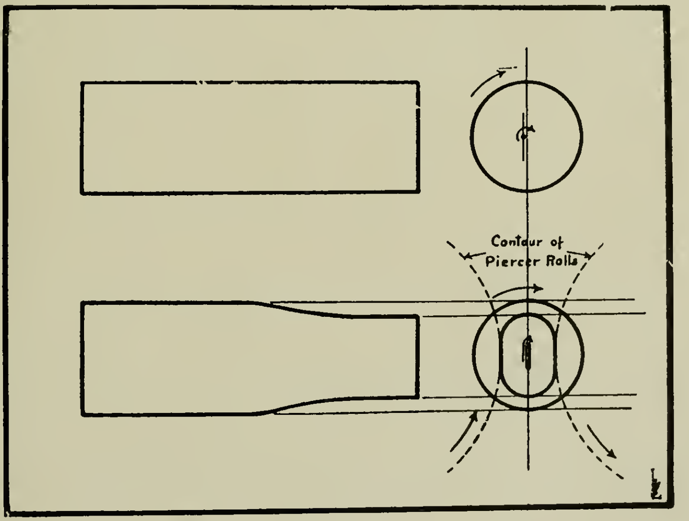

FIG. 2
(Mannesmann Pass.)

or hammered into an oval form, several times in succession, a rupture will occur in the center that will extend longitudinally through the middle of the bar. The reason for the formation of this rupture is plainly due to the fact that when pressure is applied to the round bar at diametrically opposite points sufficient to deform it, making one diameter shorter and that at right angles to it longer, the spreading of the metal, which takes place along the long diameter and in opposite directions, sets up a lateral tension that may cause its particles to be drawn away from the center. See Figure 2.

Flow of the metal in piercing: This is the action that first occurs in the roll-piercing machine. As the billet, which is in a plastic state, enters the mill, the rolls grasp it at diametrically opposite points on its circumference while it is yet about four inches from their centers. As they draw the billet forward they continue to compress it at these opposite points, and since they revolve it rapidly, these points are continually changing. In this way a small hole is quickly formed, and is then rapidly enlarged. This enlargement is due to two things. As the rolls are larger at their centers than at the ends or the points at which they grasp the billet, the increasing peripheral speed tends to produce a twisting action on the outer surface of the billet between these two points, and, as their axes are inclined to the axis of the billet, they at the same time exert a forward pull upon the outer surface of the billet. The result of this double action is that the metal is forced to flow in a spiral path, and, since the decrease in the diameter of the bar is not sufficient to compensate for this increase in length, metal must be withdrawn from the center to compensate for the deficiency.

Function of the mandrel: This opening is further enlarged by the rolling-on process that occurs as the hollow part of the billet is forced over the mandrel, or plug. This rolling-on process increases the diameter, hence decreases the thickness of the wall. As pointed out in a former paragraph, it is the practice to place the piercer point a little beyond the centers of the rolls. This position is necessary in order that the billet may be forced entirely over the mandrel before it passes from between the rolls, as otherwise the piercer point would remain imbedded in the metal. In this position the piercer point probably does some work, but the action of the rolls is the main force in pulling the metal away from the center. Since the mandrel cannot be held to an exact center to start with and it is desirable to start the rolling-on before the opening in the center is very large, the forward end of the billet is centered to insure that the point of the mandrel will penetrate the billet at or very near its axis. Centering is not absolutely necessary, but it probably lessens the power required to start the rolling-on process, and reduces the wear on the piercer point. At the end of the rolling, the mandrel bar is removed from the tube which encircles it, and the mandrel, which drops from its end, is plunged into water to cool. The process can then be immediately repeated by placing another cold mandrel on the bar as before.

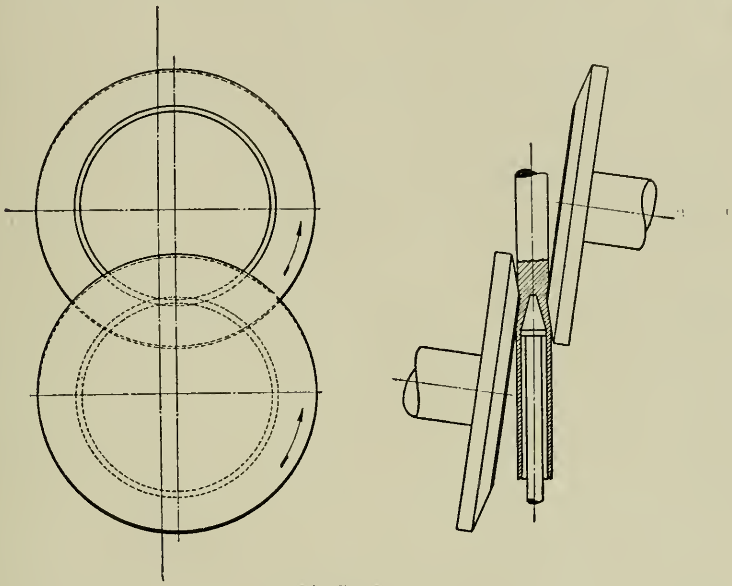

FIG. 3

The Steifel Machine, (See Fig. 3), an American invention, was patented in 1895, and up to 1918, it was the only machine used by the National Tube Company for piercing billets. The actuating surfaces for this machine, two in number, and of the same shape, have the form of large discs, and are about 30″ in diameter. The rolling faces of these discs are bevelled, or chamfered, at an angle of about 7½° for a distance from the edge equal to nearly half the radius. These two discs are mounted on the ends of two shafts that lie in two parallel lines and extend from two points in opposite directions. The distance between the centers of the shafts produced is about two-thirds of the diameters of the discs. In this way only sections of the two discs, corresponding to a little less than two-thirds of their diameters, face each other. These sections are the working surfaces of the discs, and are separated by a space slightly less than the diameter of the billet to be pierced. Each shaft is connected through gears to a main driving shaft, propelled by a steam engine or electric motor, so that both discs are revolved in the same direction and at the same rate. Between the discs and extending beyond the mill on both sides, is a trough for supporting the billet during the piercing process. This trough is fixed in a position to cause the billet to enter the mill between the discs on a level a little below their centers of rotation and along a line slightly inclined to the base plane of each.

The operation and action of the mill: Like the Mannesmann machine, the operation of the Steifel mill is very simple. The billet, which has been previously centered, is heated to a uniform forging temperature, the plug, or mandrel, supported on the end of a bar is put in position between the discs from the delivery side, and the billet is shoved into the mill from the opposite side by means of a mechanical pusher. like the rolls of the Mannesmann mill, the discs grip the billet, revolve it rapidly, pull it forward, draw out the metal to make a hole in the center, and force the wall of the rough tube thus formed over the mandrel. The effect upon the metal produced by the discs is also similar to that of the rolls. With the Steifel disc piercer, the spiral flow of the metal is more noticeable on thin-walled piercings than on heavy-walled ones. With the Mannesmann roll piercer this effect is about the same.

A comparison of processes: It is evident that the steel is subjected to very severe distortion in both these processes, and only billets of the best steel, absolutely sound and of uniform material, and heated to a uniform temperature throughout can be used. With such material, these mills pierce billets as accurately as it can be done by any other method, giving a wall of uniform thickness. This feature is very important in seamless tube making, because it is difficult to remove any variation of this kind by any of the subsequent operations. Neither mill can be used to pierce billets much less than three inches in diameter, but by subsequent rolling and drawing processes the size may be reduced to the smallest required. The disc-piercing mill cannot be constructed as rigidly nor be made as strong as the roll-piercing mill, and the latter, therefore, is better adapted for heavy work. With the roll-piercing machine, it is the general practice to make seamless tubes up to 13⅝ inches in diameter.

I might say here that a recent development, known as piercing and expanding, and perfected by the National Tube

Company, calls for the insertion between the piercer and rolling mill of a second mill exactly similar to the piercer by means of which a thick wall and small diameter tube (small as compared to finished O.D.) can be expanded to a larger and thinner wall tube before rolling. This process, modified somewhat, it is claimed, will enable the production of 16″ and perhaps 18″ O.D. tubes and is now being commercially used to produce 13⅜″ O.D. This method has only been in use a short time and the capacity of it for size has not as yet been fully determined. The movie is taken on one of these mills.

The description I have given so far will, I believe, give you some idea of the theory of our present seamless tube mill and I would now like to move on to a general description of present day practice. The steel for this product follows the general flow sheet for iron and steel to the bloom and round form. From here on however, it diverges and I will give you the actual practice as it now obtains at Ellwood City plant of National Tube Company. This plant is equipped with a 22″ continuous bar mill and six hot mills for finishing the tubes. The size blooms, usually 6″ x 6″, 8″ x 8″, or 10″ x 10″ by various weights, are selected with a view to the size and weight of tube to be made and as received are carefully inspected and any defects removed. They are then mechanically charged to a heating furnace which may be of the continuous or regenerative type, rolled to the proper diameter, and cut to the definite weight by hot saws for the tube size desired. The diameter depending on the diameter and wall of the finished tube and the weight of the round on the weight of the finished tube. Sufficient weight being allowed to cut to the required length with the desired amount of crop. Immediately following the hot sawing operation and while still hot, the billets are centerd on one end by an automatic hot punch. This is done to facilitate the entering of the piercing point. They are then charged into the piercing mill furnace which is a sloping hearth continuous gas fired furnace and rolled its length, and mechanically discharged at the other end when at about 1200-1250°C (2200 to 2300°F) depending on steel analysis. It is then conveyed to the piercing mill and by means of an air ram forced into the rolls which grip it and form a tube as previously described.

After passing over the mandrel which is supported on a long bar capable of being withdrawn from the rolls and of sufficient length to permit the pierced tube to come over it, the bar is withdrawn from within the tube and by means of skids the billet rolls to the plug mill which is an automatic 2 hi rolling mill.

It might not be out of place to give you a little history of the development of this mill as it is from this mill that the name "Automatic Mill" is derived in reference to the method of manufacturing a seamless tube as compared with the Pilger Method. Incidentally this, unlike the Mannesmann piercer, is an American development and it was with the development of this mill along with the piercer that the seamless process began to take its place along with other methods as one of the popular and economical processes.

At the time that piercing a solid billet by the means we have been considering was successfully accomplished, the art of lap welding over a plug was fairly well established, so it was only natural that the first attempts at finishing a tube should be over a plug in a lap weld roll; but since the demand for seamless tubes was for those having quite light walls and as the pierced billet was quite heavy in the wall, a very material reduction was necessary and could not be accomplished in one groove over one plug, or in one groove over various size plugs with any degree of success. It was not long before 2 high rolls containing various size grooves were employed and the billet was rolled first in one of the larger grooves and successively into the smaller ones, in each pass the plug being of such dimensions that not only was the diameter of the billet reduced, but a reduction in the thickness of the wall was accomplished, and by this means was the billet brought to dimensions that were within the range of cold drawing to finished size without what was then excessive passes. We still find this method advantageous in some sizes of tubes on account of its simplicity and the ease of obtaining different sizes without any change in equipment.

While this method of passing the tube through the rolls over a plug and bar, pulling the bar out of the tube by hand, and passing the tube by hand back over the top roll to the entering side again, was possible with light material, it becomes very laborious when the tubes were of considerable weight and naturally led to the introduction of other methods, among the first of which was that known as the gapped roll, or back-acting roll, or the Pilger process, but now universally known as the Pilger Process, and a process that is just now engaging the attention of the tube makers in this country in connection with the production of the extremely large sizes of seamless tubing and long lengths. (See Figure 4.)

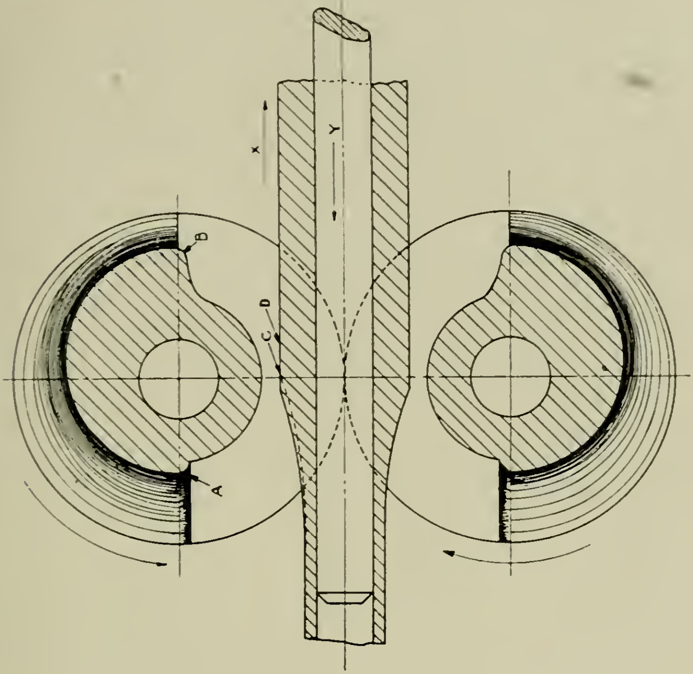

FIG. 4

In this process the billet is pierced with quite a heavy wall, about 7 or 8 times the wall of the finished tube placed on a solid bar somewhat longer than the billet, then the bar and billet are placed in front of the roll, grasped by a feeding mechanism and fed into the roll a short distance each revolution of the roll. About one-half the roll is cut away, so that it clears the work entirely and leaves a gap through which the billet is free to move. The groove in the balance of the roll is eccentric with the roll shafts and tapered from the starting to the finishing point of the groove. You will note that the straight or original body of the tube extends a little beyond the center of the rolls. The distance represents the feed or the amount of the tube that will be reduced each revolution of the rolls. The point (A) of the rolls first attack the billet at a point (C) in the billet and as the roll rotates a reduction will be effected along the dotted line (C) until the point (B) in the roll is reached. As the roll rotates, the billet and bar must move in the direction of the arrow (X) a distance equal to the circumference of the groove from A to B. When the point (B) on the roll is reached, the billet and mandrel are released and through springs or pressure cylinders in the feeding mechanism, the billet and mandrel are returned not to the original position but advanced a little further to a point (D) on the billet so that the rolls get a new bite on the billet. At the same time that this advance takes place, the bar and the billets are rotated 90° so that the opposite side of the billet is presented to the bottom of the groove where the work is performed, it being necessary to flare out the sides of the groove to prevent the edges from shearing, which would ruin the tube. And so the process continues. The rolls get a new bite and swedge that down, forcing the bar and billet back, releasing again, when the billet slides a little further through for another new bite, until the whole of the billet except that held in the grips is swedged out. As the billet is swedged out, the thinned out portion is forced off the front end of the bar so that at the finish of the operation, there is left on the bar a length equal to about the working surface of the roll. When all of the billet that can be swedged is finished, the rolls are separated, the billet and bar are passed through to a bench where the bar is extracted from the billet and returned to the mill for further use and the tube sent on for trimming and finishing.

Both the hand plug mill and the pilger mill were being used about 1900 and 1901. At this time all tubes made were cold drawn, the largest market for them coming from the bicycle factories, but about this time the demand for them slowed up and it was necessary to find new markets if the business was to continue to expand and prosper. Boiler flues seemed to offer the best field but since the lap welded tubes could be produced at a comparatively low cost and were, generally speaking, satisfactory under the conditions, then existing, it was necessary to find some way to produce seamless at much lower cost than heretofore. Therefore, a lot of experiments were started at this time seeking better and cheaper methods of production. The point of attack was first at the piercing mill where the problem was to find a way to produce a pierced billet with a wall light enough to be rolled into boiler flue gauges without excessive rolling. Another hope was that it would be possible to produce a billet from the piercing mill that could be cold drawn to a boiler flue in one pass and eliminate all rolling.

Still another hope was that means could be found whereby the tube could be rolled to gauge and subsequently smoothed and sized while hot and all cold work eliminated. So the first of what we call automatic mills was designed and erected.

This first mill was, of course, quite crude as compared with our present day mill and we might also say unsuccessful due to the fact that the intention was to follow out the hand plug mill idea and return the tube after rolling in one groove to the front of the mill and roll again and again in successively smaller grooves. This was supposed to be done mechanically, that is returning the tube to the front of the mill but the weight of the mechanism due to the fact that each groove had its own bar and mandrel, and other features proved its failure. This failure, however, did not stop efforts toward a solution of the problem and it was finally solved by the present day plug mill. (See Figure 5.)

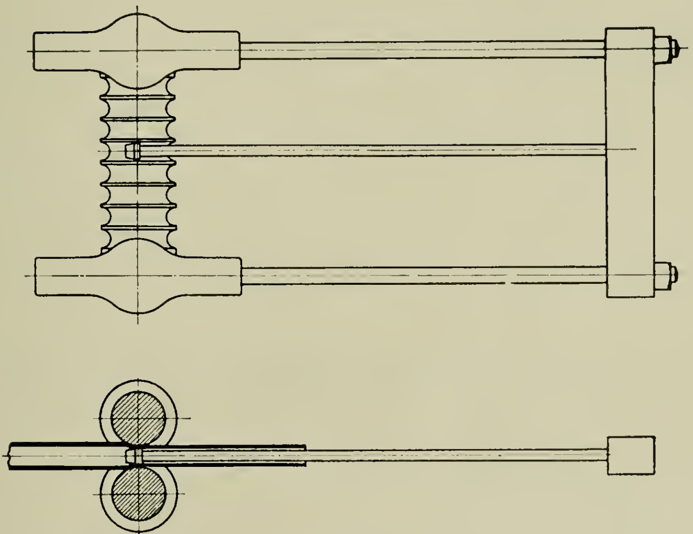

FIG. 5

The rolls of this mill contain several grooves with a mandrel inserted in these grooves and supported by a long bar. The tube is forced over the mandrel or plug and in the groove of the rolls and elongated by rolling to the desired length, the wall thickness being decreased and to the approximate O.D. desired. (The billet is returned to the front of the mill by raising the top roll automatically and using stripper rolls which will be described in the movie.) Only one bar in one groove is employed at a time however, in this mill, the development work in piercing a thin walled tube having been successful. A water cooled bar is used and is supported by barrel guides spaced at intervals along its length. Inasmuch as only one groove is used, it permits the other grooves being of either a larger or smaller size so that different size tubes can be rolled without the necessity of changing the two rolls. It is not practical to pierce as thin a wall as is always desired and neither is it the best practice to endeavor to pierce as thin as desired. In general, one endeavors to pierce as heavy a wall as possible so as to reduce the severity of action on the steel and then roll to the desired thickness on the plug mill.

As the product leaves this mill it is not especially smooth of finish or true as to diameter but the wall thickness is however, definitely determined in this operation. It then passes to the reeler which is somewhat similar to the piercing mill, being an oblique rolling operation, and which by means of another mandrel and the rolls burnishes or gives a finish to the O.D. and I.D. of the tube. (Fig. 6.) The rolls in this operation are flat however, instead of barreled as in the piercing mill. After this operation, the tube being slightly over the diameter desired, it passes to a sizing mill with a single groove or sinking mill where it is brought to size.

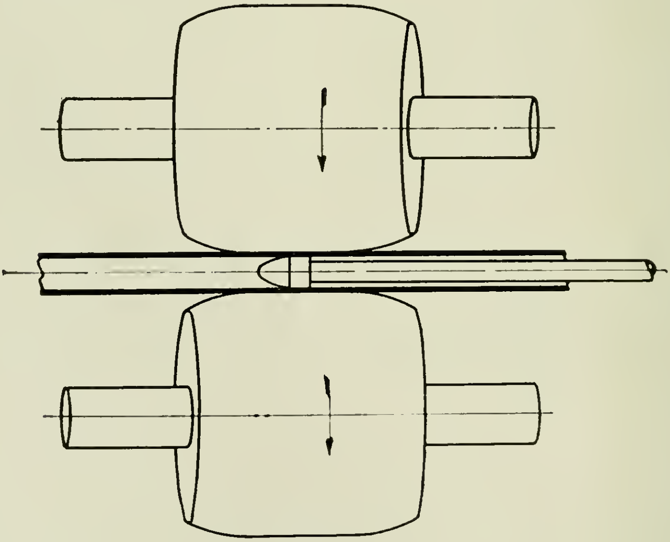

FIG. 6

Sizing may be of two types (1) Rolling between one or more pair of rolls to obtain the roundness and diameter desired, and (2) the operation known as sinking wherein the tube is passed through successive pairs of rolls of diminishing groove diameters in order to produce a tube of a diameter smaller than that practical to roll. For example, a tube of 3″ O.D. in such a mill can be reduced to 2″ O.D. or 1½″ O.D. Sizing is accomplished in this operation also. It has usually been found necessary in using this type of sizing mill to interpose after the reeling operation a reheating furnace to bring the material back to a temperature (usually above the critical point) at which it will be plastic enough to flow readily.

The sizing mill is merely a single groove 2 hi mill of such diameter groove to give the size desired allowing, of course, for the contraction of the tube when cold.

The sinking mill may consist of as high as sixteen 2 hi rolls with diminishing groove diameters, the pass lines of which are in a straight line but whose axes are set at an angle of 45° with one another. These rolls, of course, revolve at different speeds to allow for the elongation taking place in decreasing the diameter and this allowance is such as to overcome in most cases any heavying up of the wall of the tube due to decreasing its diameter.

The tube is then delivered to the cooling table.

To those who are familiar with seamless tubing the terms "Hot Finished" and "Cold Drawn" will not be new, the exact difference between these methods of finishing may not be generally understood. A tube which has gone through the operations heretofore described and after delivery to the cooling table is given the finishing operations and shipped is known as a "Hot Finished" tube. If, however, after being delivered to the cooling table following these identical operations, it is sent to the cold draw department and here given any number of draw passes and then finished, it is what is known as a "Cold Drawn" or "Cold Finished" tube.

The "Hot Finished" tubes are given, as soon as cool enough, a preliminary surface inspection and then straightened. This latter operation is accomplished on various types of equipment such as a gag press, a straight rolling operation or oblique rolling. Following this operation it can be cut or trimmed to length and it is here that the usual specification and other tests are made. A final inspection is then made on the material checking the O.D., I.D., and wall for dimension and giving the O.D. and I.D. a critical surface inspection. This final inspection is followed by hydrostatic tests for all material such as Boiler Tubes, Line Pipe, Standard Pipe and others intended to withstand internal pressure. This test is really a hangover from the welded tube where such a test was made in order to detect imperfect welds, etc., which cannot be detected on visual inspection. The absence of such a condition in seamless material however, classes this test as an additional precaution as invariably a seamless tube fails only in the presence of an injurious surface defect.

Returning now to the tube as delivered to the cooling table, we will assume that it is desired to produce from this tube one which is smaller in diameter than can be finished by the Hot Rolling process, of thinner wall, closer tolerances or better finish. This will be accomplished by drawing the tube cold through a die and usually over a mandrel, the die being of smaller diameter than the tube to be drawn and the space between the die and mandrel less than the wall thickness of the tube. It is necessary however, to prepare the tube for this operation, it not being in condition for this operation immediately following the cooling table. This is done by reducing one end of the tube for a distance of from 4″ to 6″ to enable it to be passed through the die and gripped by the pliers, which are attached to a continuous chain and pull the tube through the die. This pointing of the tube is done hot under a conventional swaging hammer. The tube is also covered with a light close adhering mill scale which must be removed by pickling and also it must be coated with a suitable lubricant. This last step is performed after the tube has been pickled and washed to remove acid and drying, by immersing in a tube containing whatever lubricant is being used. The operation is simple and suitably shown in the movie so no further description of the mechanical features will be given. The speed of drawing varies from 25 to 60 ft. per minute and the reductions in cross sectional area for any one pass from 15 to 45%. The successful drawing of a tube is much more difficult than the drawing of a solid such as shafting due to the inability to obtain as good a pickle and lubrication on the I.D. as the O.D. and also the increased surface exposed to friction. These conditions place some restrictions on the drawing of tubing not present with solids. (See Figure 7.)

As noted from the name applying to this operation, all the work on the metal is done cold or at room temperatures. Any cold work hardens the tube considerably, in fact its hardness

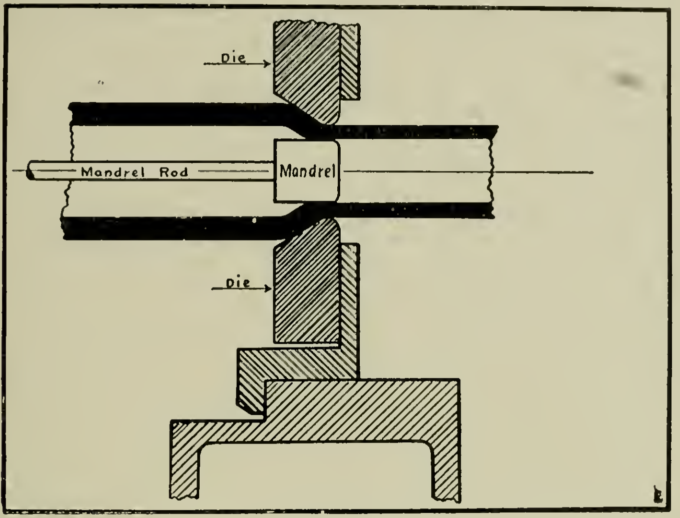

FIG. 7

is practically proportional to the per cent reduction of area resulting from the pass. Inasmuch as the smallest O.D. which can be produced (with some exceptions) hot finished is 2″ and the gauge or thickness .109″ (12 B.W.G.) with the restrictions in reducing the tube obtaining it is obvious that in some cases a number of cold draw passes must be made. In making these succeeding passes, however, it is essential that the tube be once again in a soft or ductile condition instead of hard as it is left following the preceding draw pass. This is accomplished by again annealing the tube at a suitable temperature (about 700°C—1292°F) thus relieving this cold draw hardness. The performing of this operation with its attendant scale naturally calls also for a repetition of the pickling and annealing operations. These operations are cyclic for each draw pass until the tube reaches the desired size. The inherent hardness in the tube following this final draw pass again necessitates an anneal (in most cases) before the tube is marketable. There is a difference in the degree of the anneal given the tube finally, however, depending on the physical properties desired. The anneal given between passes is such as to develop the maximum softness and ductility while in the final anneal it may vary anywhere from 400°C to about 700°C depending on the physical properties desired. The lower anneals giving the stiffer tube.

Now returning, since we have given a brief description of the two processes, to the hot rolled tube, we will discuss some of the uses and materials used in making seamless tubes. To withstand the drastic piercing operation, the highest quality open hearth steel is required and the ability to produce this high quality steel has been one of the serious handicaps of the development of seamless tubular products. In the last few years, however, the demand has increased by leaps and bounds and the production has not been able to keep pace with the demands. Some idea of the growth in the last six years can be gathered from the A.I.S.I. which quoted in gross tons is as follows:

1922—257,835
1927—864,140

Additional capacity represented by several new mills constructed in the last year or so amounting to about 250,000 gross tons will bring the capacity to well over 1,000,000 gross tons per year or an increase of from 250,000 (¼ million) to a million gross tons in a period of six years or 400%. At the same time seamless is now beginning to be used for Standard Pipe, being now available in the standard pie sizes at a nominal premium over welded. The regular boiler tube, or mild steel, as represented by .10-.20 carbon, has a prominent position among the various steels, it being used for such material as Boiler Tubes, Standard Pipe, Oil Cracking Tubes, or tubes for high pressure and temperature (although there is a tendency to allow higher carbon now since the issue of A.S.T.M. Specification A-106-26) and the regular "run of mine" mechanical. I might here explain "mechanical" tubing by saying that this is the class of tubing used for machine parts, as typified by the auto trade, bushings and other such similar uses it usually being made cold drawn. A large quantity of this analysis is also used for line pipe.

There is also a quantity of .20-.30 carbon used, it being mostly mechanical and airplane tubing, where a somewhat higher strength is desired.

Among the other plain carbon steels .30-.40 occupies a prominent place, it being used for Casing and Drill Pipe for oil country work, oil well tubing, some high pressure lines (one line 15,000# per sq. in.) and also mechanical and couplings.

Likewise, since the advent of A-106-26 there has been some of this analysis used for high pressure piping as it has a higher ultimate strength and proportional limit and consequently a somewhat higher creep stress. This grade has also been used in a few isolated cases for boiler tubes but was not enough success to warrant its adoption.

There has likewise been a number of alloy steels used such as 3½% nickel, copper bearing, low carbon chrome nickel, chrome vanadium and others. The most recent development in this line being in the stainless steels where Chrome Nickel (18-8) is being experimented with and in several cases successfully in the manufacture of oil cracking tubes. The price of this alloy is very high however, and it is not likely it will find a wide spread demand for some time until improved processes and equipment reduce its cost. Practically all of the analyses are obtainable in both the "Hot Finished" and "Cold Drawn" condition although I might say that it is quite some trick to cold draw the stainless material. It would be rather difficult to give you the physical properties of these steels in either the cold drawn or hot finished condition but I might say that the hot finished material will have about the same properties as would be expected from any other material such as bars of a comparable section. There is quite an appreciable air quenching effect on hot finished material of the lighter walls so that the "As Rolled" physicals are dependent to some extent on the section. Other variables also effect these properties such as finishing temperatures, etc. In general however, we can say that in going from a wall thickness of ⅛" to ½" and over there will be a reduction in ultimate strength of about 10% and about 25% on the yield point. These figures are based on a .30 carbon steel and would be somewhat less for a low carbon due to the fact that such an analysis is less susceptible to cooling effect.

It is still more difficult to give you any actual figures on cold drawn as the number of variables affecting the properties are for this class of material much greater. For example, we have the variables of analysis, bench reduction and final anneal. To illustrate this, let us take a steel of normal or "As Rolled" properties amounting to about 60,000# per sq. in. and having a yield point of 32,000#. Now by using a bench reduction of about 35% we can increase the ultimate strength to over 100,000# per sq. in. and the yield point pretty near the same figure. Of course, this is all done at the expense of ductility and the tube in this condition is quite hard or brittle. This is where the final anneal serves its purpose so that after making a tube with such a reduction some of the embrittlement can be removed and the tube restored to either its original or an intermediate condition depending on the properties desired.

Before closing it might be well also to say just a word about variations or tolerances that can be maintained on such material. As would be expected it is not possible to maintain on "Hot Finished" tubes the nicety of control of dimensions that are feasible on cold drawing due to the fact that—(1) Hot steel does not permit of the close observation and measurement while being worked as does cold steel and (2) the equipment adapted to hot working is more rugged and not as delicate of adjustment as that used for cold work. For example, 3/64″ tolerance may be taken on a 3″ O.D. hot finished tube while such a tube cold drawn and with a light final anneal can be finished to .010″. There are, of course, also conditions where even cold drawn, however, we could not work to .010″ on a 3″ tube such as on tubes with very light walls as compared to the O.D. on which a certain amount of ovality may result and also on the higher anneal where not only scale conditions effect the tolerance but also out of roundness due to sagging of the tube at the high heat of annealing from its own weight. These matters are, however, more or less detail but it will give you some idea of what can be done with seamless as compared with lap welded and butt welded.

Now if you will permit me we will pass on to the movies. These pictures were taken at the Ellwood City Plant of the National Tube Company which was the first of the modern seamless tube plants to be constructed and also the largest. It is from this mill that the seamless tube industry has developed. The particular hot mill which will be shown is the first Piercing and Expanding Mill built and is the pattern for all of those which have followed.

PRESIDENT: Before we go into a discussion of the paper, we have with us one of our members who has something on his mind, which is the impelling force that has brought him to Pittsburgh and to this meeting tonight. He feels that he must get it off his chest, so Mr. Devans, Past President of this Club, you are afforded opportunity to say what you please at this time.

MR. E. J. DEVANS: Mr. President, Members and Guests: Yes, I would like to say a word or two. Ordinarily I resent the invitation to talk, but on this occasion I would like to say a few words. I am informed that the reason for my absence at the Annual Meeting was due to illness. I am afraid some of my friends, in order to fix up a reasonable excuse, made the statement that I was ill. The real reason, however, was due to conditions beyond my control and contrary to my desire to be present on that occasion.

I desire to express at this time my appreciation to the members of the Club and the committee responsible for the selection of the wonderful presents of which I was the recipient. Nothing else that you could have given me would have pleased me quite as much. I cannot think of anything in the presents selected—fishing tackle of every variety and a magnificent gun, as well as a very handsome picture of a hunting scene—that at least an amateur sportsman, or, for that matter, a professional would find wanting when he might hie himself away to the streams or woods and, again I thank you.

PRESIDENT: Gentlemen, the presentation of this wonderful paper and these moving pictures has been so complete that I do not know whether there is any question you would like to ask or not. If there is, I think Mr. Passmore has voice enough left to answer. Are there any questions? Mr. Seley, would you care to add anything?

MR. C. A. SELEY: I do not know that I have any question. I do wish to express my appreciation of the young gentlemen who have given us such an intelligent and adequate view of the entire process of tube production. I had no idea there was so much to it in detail.

PRESIDENT: Does any one else desire to make any remarks?

MR. P. A. BEVAN: I would like to ask the speaker whether the A. O. Smith resistance butt weld is causing the National Tube Company any trouble.

MR. PASSMORE: Do you speak of the seamless tube?

MR. BEVAN: The welded tube.

MR. PASSMORE: I cannot speak for the lap weld, but as far as the seamless tube is concerned, I can say no. Does that answer the question?

MR. BEVAN: Yes sir.

PRESIDENT: Mr. Selkirk, would you add something?

MR. W. M. SELKIRK: (Chief Engineer, Seamless Tube Division, Pittsburgh Steel Co.) Mr. Chairman and Gentlemen: I have not prepared a written discussion of the paper. I think that it has been very well presented and in full detail and have no remarks to make concerning it.

Perhaps it will be of interest to those present to know that one of the main advantages of the Pilger Mill over the Automatic Mill as described tonight is that while in the Automatic Mill it is necessary to use rolled billets, the Pilger process permits the use of cast ingots. Cast ingots have been used in Automatic Mills in Europe for sometime, but tubes cannot be produced economically by this means in this country since it constitutes as many as eighteen passes for the pierced billet in the Automatic Mill to produce a finished tube from the cast ingot.

In regard to the length of tube that can be produced in the Automatic Mill, I think about 50′ is the maximum. The Pilger Mill will produce tubes of much greater length and I believe of heavier walls than is possible to produce on the Automatic Mill. Tubes have been recently produced on Pilger Mills in this country considerably over 100′ in length, I think 132′. Tubes of this length cannot be produced on the Automatic Mills.

I think the paper has been very well presented and that the author should be commended very highly.

MR. G. P. McNIFF: Regarding the Pilger process, although this method can make a tube 130 ft. long, what is its commercial use? What can be done with it? Could a tube like this be shipped on our railroads? Even if this would be possible, the handling of the length in any oil field would be nearly impossible.

In regard to the Pilger process not using a bloom or rolled product, but piercing a heavy wall casting, this is commercially possible although the work done in the many passes in the blooming and bar mills has its very great advantages as to quality. It takes a very fine quality of steel to make a tube in the automatic mill as the piercing to a much thinner wall thickness requires the highest quality of steel, whereas the Pilger process of piercing a heavy wall does not require this exactness in quality.

PRESIDENT: Mr. Passmore have you anything further that you would like to say?

MR. PASSMORE: I do not believe there is anything further I would wish to say. I can only repeat that I am sorry that I was not able to read the paper myself. But I want to thank Mr. Findlater for reading it for me. I do not know that I have anything more to say. If any questions come to your mind later that you would like to ask, we would be only too glad to answer them.

MR. SAMUEL LYNN: I am not going to try to discuss the paper of the evening as in my opinion it is a subject which the ordinary railroad man has not had an apportunity to get sufficient information on to be able to discuss intelligently. However, I was very much interested in the question Mr. McNiff brought up as to how we would handle shipments of pipe having a length of 132 ft., in other words, I am wondering what we would do with shipments of this kind if they were offered to the railroads for movement. As a number of the gentlemen present know, I am a member of the American Railway Association Loading Rules Committee and very much interested in the formulation of A.R.A. Loading Rules for the safe handling of various commodities. With particular reference to pipe shipments the Loading Rules Committee has recently had some very interesting studies and experimental tests to improve their rules for the handling of pipe shipments, however, the Committee has not as yet had the problem of trying to formulate rules to take care of pipe or tubes 132 ft. long, and I question whether tubing of this length could be loaded and handled in volume by the railroads successfully.

Going back to the paper of the evening, I feel sure that every member present will agree with me in that we have had a most interesting and instructive paper, and I would, therefore, like to make a motion that Mr. Passmore and his associate be tendered a vote of thanks for the paper and illustrations.

The motion tendering to Mr. Passmore and Mr. Findlater a vote of thanks was duly seconded and carried by unanimous rising vote.

Upon motion, duly seconded, meeting adjourned.

J. D. CONWAY, Secretary.

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W. H. HOLBROOK
Died February 22, 1928

EGBERT H. GOLD
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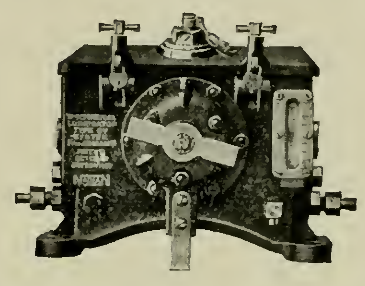

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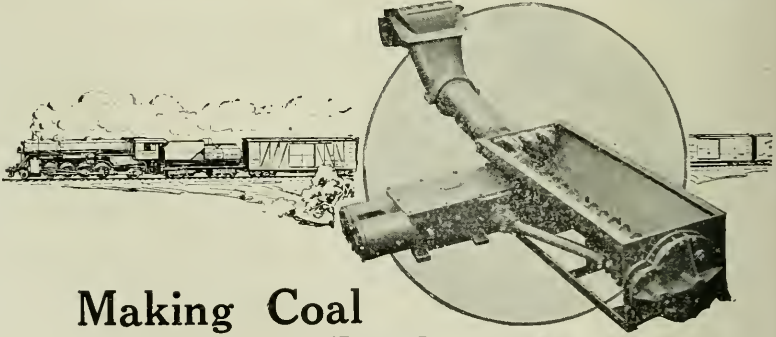

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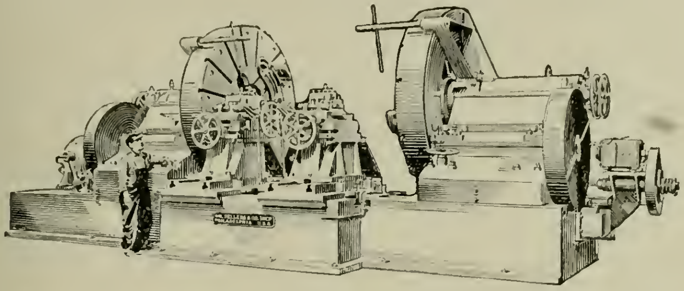

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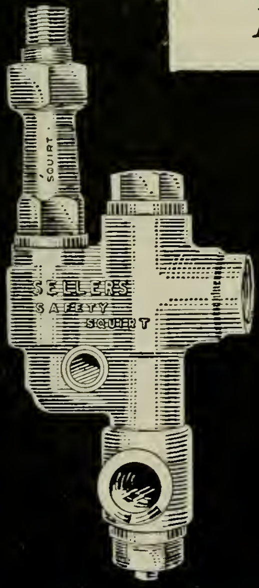

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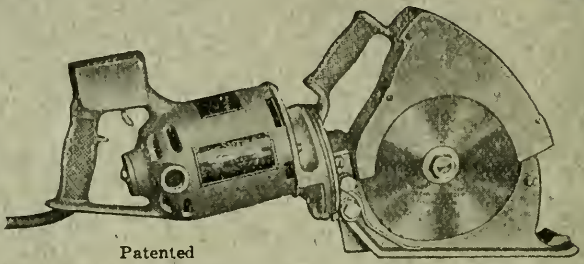

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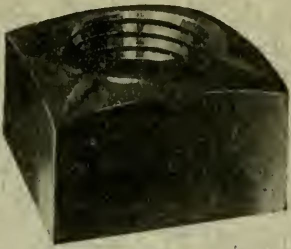

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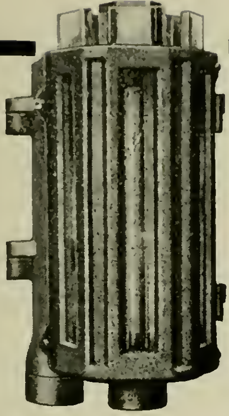

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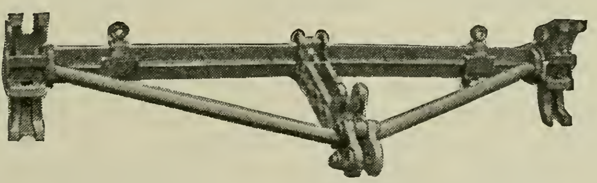

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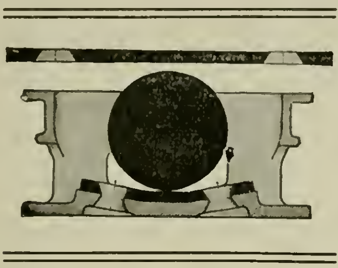

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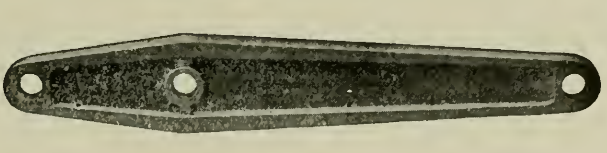

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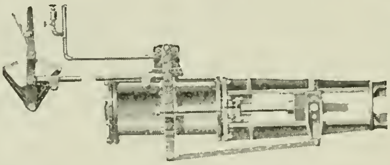

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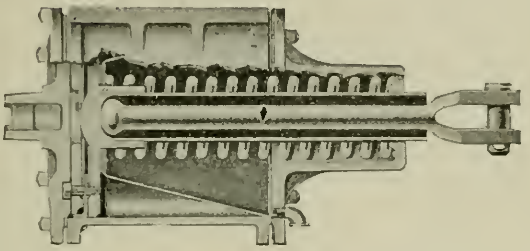

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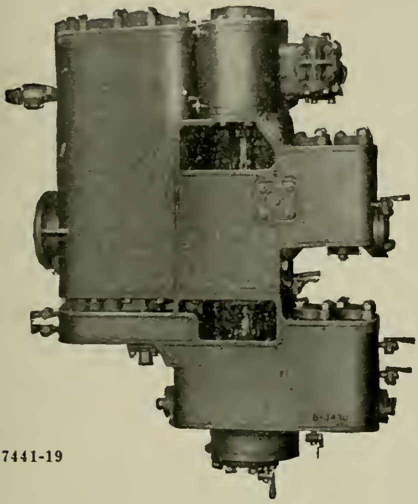

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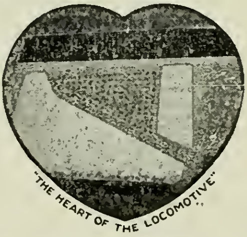
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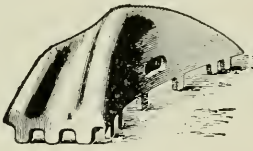

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Fig. 436 C

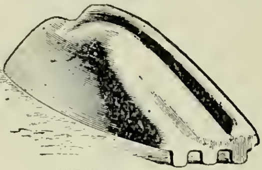

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Fig. 437 C

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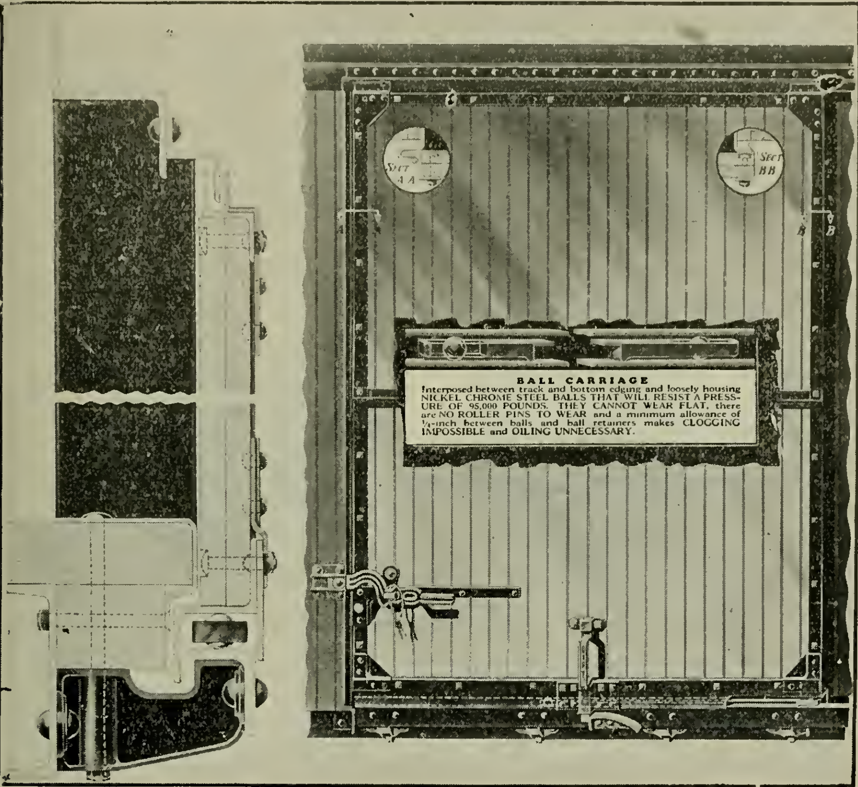

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OFFICIAL PROCEEDINGS
OF

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*J. H. McCONNELL	October, 1901, to October, 1903
L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
*J. A. SPIELMANN	November, 1918, to October, 1919
H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
DECEMBER 27, 1928

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

MEMBERS

Allen, Harvey
Altsman, W. H.
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Berghane, A. L.
Bowen, James T.
Cipro, Thomas
Conway, J. D.
Cunningham, R. I.
Dambach, C. O.,
Davis, Charles S.
Dempsey, P. W.
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Endsley, Prof. Louis E.
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Frauenheim, A. M.
Goda, P. H.
Hansen, William C.
Hastings, W. S.
Loeffler, George O.
Long, R. M.
Ludgate, B. A.
Lynch, C. A.
Lynn, Samuel
Mitchell, W. S.
McHugh, C. A.
McAbee, W. S.
McKinley, Archie
Rizzo, C. M.
Semethy, J.
Showalter, Joseph
Stamets, William K.
Stoffregen, L. E.
Stucki, A.
Sutherland, Lloyd
Warfel, John A.
White, A. B.
Wright, John B.

VISITORS

Bowden, F. S.
Bradshaw, C. O.
Crocker, Albert E.
Davis, I. M.
Davis, William B.
Downing, R.
Lewis, S. B.
Schrontz, S. B.
Smith, Sion B.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Bowden, Foster S., Assistant on Engineering Corps, Pennsylvania Railroad Company, 510 Ferndale Avenue, Johnstown, Pa. Recommended by J. D. Conway.

Emerick, J. B., Salesman, Garlock Packing Company, Chamber of Commerce Building, Pittsburgh, Pa. Recommended by Henry F. Gilg.

Filson, Harry T., Engine Dispatcher, Montour Railroad, George Street, Coraopolis, Pa. Recommended by E. A. Rauschart.

Griffith, F. A., District Manager, Garlock Packing Company, Chamber of Commerce Building, Pittsburgh, Pa. Recommended by Henry F. Gilg.

Hall, Chester C., Clerk, Rieck-McJunkin Dairy Company, 4119 Millington Road, Pittsburgh, Pa. Recommended by Oscar G. A. Moyer.

Tate, Ralph H., Vice-President in Charge of Sales, Fort Pitt Spring Company, P. O. Box 917, Pittsburgh, Pa. Recommended by D. S. Molyneaux.

Verret, Roy H., Engineer, Fort Pitt Spring Company, P. O. Box 917, Pittsburgh, Pa. Recommended by D. S. Molyneaux.

PRESIDENT: These applications will be referred to the Executive Committee, in accordance with our By-Laws, and upon approval by them, the gentlemen will become members without further action.

SECRETARY: Since our last meeting we have been advised of the death of two of our members—Charles Thomas died December 15, 1928, and Latimer L. Rowles died December 25, 1928.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

If there is no further business, we come to the paper of the evening, and I now have the pleasure of introducing Mr. C. O. Bradshaw, Vice-president, Robinson Connector Company, New York City, who is going to talk to you from his personal experience. He is a practical man in the full sense of railroad work, and I think we will all understand what he has to tell us this evening on the subject, "Benefits and Economies of Automatic Connectors."

MR. C. O. BRADSHAW: Mr. President and Gentlemen: When this Club extended the invitation to my associate, Mr. Robinson, to address this meeting, he had fully expected to be here. But on account of serious illness in his family he found it necessary to make a trip to the Pacific Coast and therefore I am pinch hitting for Mr. Robinson tonight. I am sure you would have been interested in hearing Mr. Robinson on this important subject of automatic train pipe connections, for he is the outstanding engineer in the development of the automatic connector art.

However, I have prepared a paper, not from a highly technical standpoint but from the standpoint of a practical railroad officer. I have been in the railroad service for the past twenty-five years, up to the first of this year, before I became associated with the Robinson Connector Company and other interests in the East. I shall not be in position to enter into a technical mechanical discussion of automatic connectors. But I will be very glad to discuss this important subject from an operating standpoint.

In my experience in the last ten or twelve years as a railroad officer I have attended many club meetings where technical papers were presented, and in many cases it has been my experience that some of these papers were too highly technical and statistical to command the attention and stimulate the interest that was necessary. And having these things in mind, I have prepared a brief paper on automatic connectors, which I will be glad to discuss further after it has been read.

BENEFITS AND ECONOMIES OF AUTOMATIC CONNECTORS

By C. O. BRADSHAW, Vice President,
Robinson Connector Company, 415 Lexington Avenue, New York, N. Y.

The function of transportation is to overcome the economic handicap of distance. We have created in this country the most extensive system of railroads and have the most efficient transportation at the lowest cost of any country in the world.

This wonderful system is the result of efficient management, improved methods, and modernized equipments and facilities. However, the pressure for further operating economies is still a daily problem. Therefore, the question of universal adoption of a practical train pipe Connector must receive serious consideration.

Automatic Connectors for freight and passenger cars is an old subject—and at the present time a live subject—in fact to couple and uncouple train pipes automatically is the missing economic link in train operation. The Interstate Commerce Commission, the American Railway Association, and progressive railroad men are now giving this subject serious consideration, and in each instance the question is asked—Has a practical Connector been developed—one that is fool-proof, simple of design and low in first cost and maintenance? Also, will the universal adoption of this device pay a profitable return on the investment and afford added safety to employees?

In answer to these questions we earnestly answer YES, and this affirmative answer is justified by present day Connector developments in which a practical Connector has proven its ability to reduce terminal delay, facilitate train movements, eliminate the time element in coupling hose, improve brake operation and increase the factor of safety to employees.

The manual coupling of train pipe connections is out of step with other modern methods of performing other functions for which locomotive and car equipment accessories of an automatic character are provided, and the present day Connector has arrived at the point where demonstrations will prove the economies and safety claimed for it.

The item of time is probably the most important of all considerations, except that of safety, in railway operation. In the manual coupling of air and steam hose the time consumed is proportional to the number of hose couplings to be made in getting the train ready for the road, since all of them must be made after the cars composing the train are coupled together. The time consumed in any given case will depend on the condition of the hose couplings and gaskets at the time the car inspector or the trainman, as the case may be, arrives at the different locations where the couplings must be made. If the couplings and gaskets are in suitable condition and the weather mild, the couplings can be effected in about the usual time required for the inspector to go over the train to reach them plus an additional ½ minute for each coupling made; but if the number of couplings that must be made is large, the aggregate time consumed in making them will be correspondingly large.

The time consumed in coupling hose in cold weather may be conservatively estimated at ¾ minute per coupling, when the couplings and gaskets are in as good condition as the temperature conditions will permit and the hose are still flexible enough to be handled with a moderate degree of facility; but when the hose are frozen stiff it is a difficult matter to make a satisfactory coupling at all. Where the inspector finds the couplings themselves in damaged condition requiring in some cases change of hose or the gaskets worn and abraded so as to require changing, considerably more than the average time allotted for making hose couplings will be consumed. This additional time not infrequently occurs when it can least be spared and when it sometimes causes interruption of train schedules.

The practice of pulling hose apart while under pressure is very injurious to brake pipe, hose, and gaskets, but it is condoned because of the time saved, especially in critical situations as they may affect train schedules, and because the hazards to trainmen are reduced by this practice. The damage resulting from this practice, however, must be repaired, if the brake pipe is to be put in satisfactory condition before the car is put in another train, and to make such repairs entails loss of time to the equipment in many cases and in any case constitutes an item of expense.

The Connector, by simultaneously connecting the train pipes at the instant the car coupling are made, and by separating them with the separation of the cars, eliminates entirely the time element, the damage to hose, hose couplings and the brake pipe, and the personal risk and hazard attending hand coupling; therefore it effects large economies in respect to these matters.

Probably no feature in connection with air brake operation is more highly stressed these days than that of good brake pipe maintenance, for there is nothing in connection with air brake operation that adds more to the safe, economical, and efficient functioning of the air brake than a tight brake pipe. The Connector by simply eliminating all strains on the brake pipe and air hose now imposed by the hand coupling makes easily possible a constant uniformly tight train line. Even though the brake pipe may after careful preparation in the terminal have all its hose and hand couplings put in the best of condition it may not remain in that condition long after the train gets in motion in transit over the road; but with the Connector, the train line once made tight will remain that way over the entire division. It should be borne in mind, too, in connection with this matter that as the number of connectors in service increases the need for special preparation of brake pipes in terminals will diminish.

A most important economy is the reduction of leaks in train lines and fuel conservation. For example, a Committee of supervising air brake representatives from the largest rail lines in the country were called upon to make a careful study of train pipe leakage and fuel economy, and the following extracts are quoted from their report:

> "This committee, after careful and deliberate study of the air-brake situation, announced that the leakage of air in brake pipes and connections under freight cars was responsible for an annual loss of over 6,000,000 tons of coal. With the exception of train-line losses incurred in controlling trains on heavy descending grades, it is estimated that 95 per cent of the fuel consumed in compressing air on locomotives is used to make good this brake pipe leakage."
>
> "Specific tests have shown that a train-pipe leakage of 7 pounds per minute on a 50-car train entails a loss of more than 39 cubic feet of free air per minute, and absorbs 91 per cent of the capacity of one 9½-inch pump or 59 per cent of the capacity of one 11-inch pump. Under conditions that frequently prevail on 50-car trains the brake-pipe leakage often amounts to more than double the quantities stated."

In addition to the above statements, an authority on air brake matters makes the statement that the saving through the elimination of train pipe leakage is estimated to be many dollars per car per year—an amount approximating the first cost of freight Connectors.

Air hose when not coupled to a mating hose are allowed to hang in such fashion as to sustain considerable pressure from the angle cock hose nipple, and this pressure has a tendency to abrade and cut the inner tubing so that after the hose has been in service a short time it is approaching a condition which is likely to result in failure while under pressure in trains moving over the road; if failure occurs while the train is in motion it is almost always attended with seriously damaging consequences, and regardless of whether the train is in motion or standing, hose failure is always attended with serious delay made necessary in the work of replacing the ruptured hose.

Air hose that are allowed to hang from the brake pipe while cars are being switched are often damaged and sometimes pulled off the brake pipe because of coming in contact with obstructions on the track. When they meet with such mishap they are seldom fit for further service, and the damage sustained by the brake pipe entails an additional item of expense in the repairing necessary.

With the Connector the two ends of the hose are always in the same relative position with respect to each other, and they hang in a graceful curve with the connecting ends effectually protected from mechanical damage by the connector heads; and they are entirely free from all hose nipple pressure and from danger of coming in contact with road obstructions.

Briefly the sources of Automatic Connector benefits and economies are tabulated as follows:

1. Speeds terminal operation.
2. Reduces road delays.
3. Greatly prolongs the life of hose and gaskets minimizing Train Line Maintenance.
4. Reduces break-in-two's due to frequent bursting of hose. Break-in-two's damage equipment and often cause derailments and collisions.
5. Improves brake operation, and hence gives better control of train.
6. Reduces triple valve maintenance costs by providing a cleaner train line.
7. Reduces brake shoe wear and prevents "creepy" brakes.
8. Saves the fuel now wasted in pumping against train line leakage.
9. Increases car miles by speeding up the movement of trains, and hence reduces new car requirements.
10. Increases tonnage where brake control is the determining factor.
11. Reduces personal injuries by keeping men from between cars.
12. SAVES TIME—now the chief element in transportation.

Therefore, it is felt that the judgment of railroad officers in considering this important matter must suggest automatic connectors as an investment for, rather than a mortgage against, the future, and when all the facts are considered it is a pertinent question whether the railroads can afford not to adopt this modern method of connecting train pipes, instead of, can they afford to adopt it?

PRESIDENT: Gentlemen, you heard Mr. Bradshaw say that he would not try to answer any technical question but that he would be glad to answer as far as he could any question you may wish to ask on the practical or operating side of the subject. The paper is now before you for discussion.

MR. C. O. DAMBACH: I would like to ask the speaker whether there has been any provision made between the different connector companies—assuming we will have more of them if this device is put into operation—which will permit coupling up of connectors made by different manufacturers, or whether we are going to have another "57 varieties" the same as we did with the automatic couplers when they were generally adopted.

I would also like to ask whether there has been any provision made for individual application of these connectors before they are universally adopted.

MR. BRADSHAW: These are important questions. We all recall the adoption of the automatic car couplers and the mistakes that were made due to the absence of standardization. However, with the universal adoption of automatic train pipe connectors there will no doubt be a standard set up by the American Railway Association; in fact, the Automatic Connector Committee appointed by the Association has been working on this problem for more than a year, and there is a Special Committee in the field at this time making a careful investigation of all automatic connectors. No doubt any connector that has merit will be given careful consideration and tried out in service before the Committee decides on standards. However, there is no question whatever that a standard contour of the connector head will be necessary, and of course the brackets and support will have to be so designed as to carry this standard head, in order that all the devices will be interchangeable.

One of the most difficult problems in standardizing connectors is to secure an interchange device that is entirely practicable to carry the installation of connectors through the transition period. Those of you who attended the Atlantic City Convention, last June, and observed the demonstrations of connectors there will keep in mind particularly the simplicity of the Robinson Connector interchange device.

MR. R. M. LONG: I would like to ask, suppose you pull your drawhead out, does that pull out the connector with it?

MR. BRADSHAW: It has been proven by years of development work that the practical connector must be attached to the car coupler by a supporting lug, therefore in the event of pulling out a draw head the connector is pulled out with it. However, there is no more damage done than with the ordinary hand hose coupling, and on the other hand you do not pull out as many draw bars at the present time as you did a few years ago.

MR. LONG: I do not understand how you protect your device on the rear end of a train in freezing weather.

MR. BRADSHAW: The Robinson Connector is so designed that snow and sleet will not gather in the ports or on the face of the connector to the extent that the coupling impact will not dislodge it. We also have a most effective and practical design of gasket which you no doubt observed during the demonstrations at Atlantic City, last June, and this gasket is also helpful in making a tight joint under adverse weather conditions. This question is best answered by the fact that the Robinson Connectors were installed and operated for several years on Canadian railroads, and it was proven quite conclusively that extreme weather conditions did not affect the connector.

MR. LONG: That does not occur in this particular joint. what you say about the maintenance of gaskets. I do not want to leave the impression that trouble occurs all at this particular joint. Only about 20 per cent of the leaks are found in this particular joint.

MR. BRADSHAW: I think that is true up to a certain point, but you must agree that there is a considerable additional train pipe leakage that occurs in spongy hose, leaks that are not audible, and this is brought about more or less by pulling air hose apart under pressure, causing a rupture of inner fabric of the hose.

MR. LONG: That is true but on the railroad that I represent the train load is a train of 115 to 120 cars and our brake pipe leakage is less than five pounds per minute.

MR. BRADSHAW: No, that is exceptionally good, but there are very few trains of that size where the train pipe leakage does not run from 2 to 3 times that much per minute.

MR. LONG: Just one more question. What assurance have we that we will reduce this leakage by your device?

MR. BRADSHAW: Results obtained by tests of connectors in service have demonstrated the fact that this device does reduce the train pipe leakage materially. But in order to secure reliable figures it will be necessary, of course, to get large installations of automatic connectors, and do the things that have been done with other railroad equipment of a like nature and develop the facts by continuous service. However, the connector art has been developed to a point where it is quite obvious that the Robinson Connector particularly reduces train pipe leakage to the lowest possible minimum. We must also keep in mind the trend of air brake development along the line of reducing of curves and right angle bends in train lines.

MR. LONG: The hose coupling that is now being made and is in use we do not have the deteriation of the metal at the gasket groove that we did have before.

MR. BRADSHAW: With the hand couplings you have many right angle bends, in fact 2 in each joint, but with the connector you have a nice easy curve, one that does not retard the flow of air, and this is a saving. On the other hand, we have a gasket and gasket seat that is well designed and it is admitted by experts that our gasket will give better service and make a tighter joint than the gaskets now in common use on railroads.

MR. LONG: Your device will certainly be a big help to eliminate leaks in severe weather while train is in motion, as the present day rubber hose freezes and with excessive slack in draw heads and especially on curves raises the hose causing a leak. This usually causes a brake application which is very annoying, and causes delays, your automatic coupler will eliminate this trouble.

MR. BRADSHAW: Yes, that is true, and particularly in a cold country where you have extreme track curvatures. Hose are frozen and going around these curves, especially where there is an excessive amount of slack, hose are sometimes pulled apart and in many cases develop excessive leaks. But with the automatic connector it is impossible to have a situation of this kind, as the connectors remain tight, regardless of track conditions.

MR. LONG: There is no question in my mind but that we are shortly coming to some automatic coupling device that will couple the steam and both air lines. This will eliminate a number of accidents to train men and car repairmen and also do away with a lot of delays that are now occurring with the present equipment.

After examining and reading over a number of devices of this kind I feel that your device is pretty close to what the railroads are looking for.

PRESIDENT: Would any one else like to ask a question?

MR. BRADSHAW: If there is no further discussion, I would like to suggest that if there is any further information desired by the members of your Club, or others in this vicinity, we will be glad to supply the information on request.

PRESIDENT: We have a gentleman here who travels the United States very extensively and follows up the question of air and tells us how to use it. Mr. Cunningham have you a word to say?

MR. R. I. CUNNINGHAM: Mr. President, I did not expect to enter into the discussion of the paper which has been presented tonight, therefore, am not fully prepared to say much that would be of interest to the members of the Club.

From my past experience as an Air Brake Expert, I am sure I can say, without fear of successful contradiction, that one of the most agravating troubles experienced with the operation of Air Brakes, especially on long trains, is excessive brake pipe leakage, for the reason that it not only results in excessive fuel consumption, interferes with the proper release of brakes, reduces the life of the compressors, but it also interferes with the engineer's desired brake pipe reduction when making stops or controlling trains descending grades, and often times results in having the train stop short of the desired location or reduces speed of that intended when controlling trains on a grade and as a result, much damage is done to drawbars by causing the engineer to release the brakes when a release should not be attempted and, therefore, I am fully in accord with the paper presented by the speaker of the evening.

From a safety standpoint, there is no question but that it is a desirable device. I know of one large road in the Eastern part of the country which considers this point of sufficient importance that they have gone to the trouble of designing a suitable three-pronged iron by which the inspectors could couple and uncouple Air Brake Hose while the train was being shoved over the hump in the Classification Yard, thereby, saving time and eliminating the danger of inspectors being injured by going between the cars to perform this duty and, of course, automatic brake pipe connectors would eliminate this necessity.

Mr. Long has just told us that he has reduced brake pipe leakage on his long freight trains to three or four pounds per minute and I wish to say that that is mighty good work, and I am sure that he has gone to considerable trouble and work to get the brake pipe leakage down to this point.

In fact the railroads throughout the country, generally, have made great advancement during the past few years in the way of improving leakage conditions which has been instrumental in improving train handling. The Air Brake manufacturers have also been alert in improving this apparatus, notably the hose couplings, which alone contribute a large share; the angle cock having extension for "U" bolt to permit of rigid clamping of the brake pipe; the brake cylinders; Wabco packing, dirt collector, and other parts, all of which have been worked out with this end in view.

The speaker of the evening has called attention in his paper to the trouble experienced in Canada with brake pipe hose freezing, which resulted in considerable leakage at the hose coupling gaskets, especially when excessive slack developed between cars. We have experienced the same trouble in this country, especially in the mountainous territory, the result of which required many minutes and even hours to get the train over the road due to this trouble, and I heartily agree with him in his statement that this device is a most important thing to the railroad operator.

There is no doubt in my mind but that some of the Railroad Operating Officials would hesitate in adopting a device of this kind and especially applying it to present equipment. Possibly the chief reason for this, aside from the cost, would be the matter of interchange with all classes of local and foreign cars. As for the practicability of the device, however, I wish to state that the Westinghouse Air Brake Company developed an automatic air and steam connector, which was installed on all passenger cars and locomotives on the Long Island Railroad, twenty-five years ago. They have been in continuous use during that time, and are still maintained as standard on that road.

PRESIDENT: We have a man here tonight who comes from a cold part of the country, the place where they make the weather, Mr. White, of the B. R. & P. I do not see him just now, I guess he must have had warning that I was going to call on him and left. But there is another member here who can always talk on any subject, Mr. Stucki.

MR. A. STUCKI: It just occurs to me that only a few years ago we started with four wheel brakes on automobiles and every one asking me then as to their merit I recommended them highly, because the underlying principle was based on common sense. Some feared too much braking power on the front wheels and others objected to the rather complicated transmission of motion from the chassis, which is stationary, to the front wheel, which is movable. All these questions may have been justified in the beginning, but if the fundamental principle is sound, such details will gradually be perfected. And I feel just exactly the same way in regard to automatic couplers. I do not know about your particular device, whether you have horizontal guides, right and left, to guide them into each other, or whether you have a male and female joint; I do not know whether your hose loops are horizontal or hang down. There are dozens of questions that one might ask, but I feel that if you are not doing everything just right at this time, a solution will suggest itself, and you will have a thoroughly practical device some day and I do not doubt for a moment that we will have automatic couplings before very long.

PRESIDENT: Mr. Berghane, of the Westinghouse Company ought to be able to tell us something interesting on this subject.

MR. A. L. BERGHANE: Mr. President and fellow Members, I do not believe I can add anything to what Mr. Cunningham and Mr. Long have said. I have had practically no experience with any of the automatic couplers. But I will say that I think it is a step in the right direction. The chief difficulty back of the introduction of a device of this kind, as I see it, is to get a design having a coupling face contour which will permit of couplers of different manufacture to interchange on cars throughout the country. At the present time, I understand that there are several different forms of automatic connectors, but that none of them will interchange with the other.

Unless a standard is adopted, there is no question that an improvement along this line would be welcome by the railroads.

PRESIDENT: Mr. Berg would you care to add anything in the way of remarks?

MR. KARL BERG: Mr. President and Gentlemen, I think I will have to concur in the statement made by some of the previous speakers, that is, I have no practical knowledge of the performance of the automatic connector, and therefore, am not qualified to say anything either for or against it. I do think, however, that in time a connector will be designed that is mechanically sound and practical, and that such connector will then be uniformly adopted. Such a step is in the line of progress, and there is no reason why the adoption should be more difficult than the adoption of the automatic coupler years ago.

I do not care to say at the present time that this particular type of connector has been designed, as I have no personal experience in connection with any of them.

MR. SAMUEL LYNN: I had in mind to ask one or two questions, but some of the others have already asked the questions. However, Mr. Bradshaw has stated that the American Railway Association now has a Committee making a thorough and exhaustive study of this subject. Under these circumstances we men in the railroad game who have to do with the maintenance of cars, and try to keep them so they will all run over the railroad, and maintain the air brakes so that they will function properly, will probably get the benefit of that study when it is compiled.

Mr. Bradshaw has also stated that he has heard some very good things about the Railway Club of Pittsburgh. It is unfortunate that he comes to us at a time when we are in the midst of holiday activities and the "flu" epidemic, which conditions are largely responsible for the small percentage of our membership in attendance tonight. Otherwise he would have met a very lively bunch of real fellows. What we are lacking in numbers tonight we will have to charge up to the above causes.

Mr. Bradshaw has given us a very interesting talk on the subject and I would like to move that he be extended a rising vote of thanks as an expression of our appreciation of his excellent paper.

The motion was duly seconded and prevailed by unanimous vote.

PRESIDENT: Before we close the discussion, we have another gentleman here who can talk on almost anything and is never at a loss for an interesting comment, Professor Endsley.

PROF. LOUIS E. ENDSLEY: I was very much interested in the address, particularly in that phase of the subject where we are able with a weight of only forty pounds to put on such a device. Another thing that went through my mind was that three-quarters of a minute per car is 75 minutes for a 100 car train.

To say just a little about hose, some years ago I had the pleasure of detailing to two of my boys the subject of finding out how much leakage was in the middle of the hose, at the end joints, and at the point where the crimp comes in. One of the boys devised a very neat arrangement by running the hose through water, and by putting pressure into the hose the leakage of air at any point came up in the water, and was caught in the proper compartment.

They found that the crimping accounted for 65 per cent of the leaks through the hose. And I can see that any form of connector would save the hose very materially from that crimping from weight or something else beside itself. If it is held at two ends it only has to carry its own weight.

I enjoyed the talk very much. I am sorry there are not more here. This is the smallest meeting of the Railway Club of Pittsburgh that I ever attended, and I have attended a great many in the last fourteen years.

PRESIDENT: Is there any further discussion? If not, a motion to adjourn will be entertained.

ON MOTION. Adjourned.

J. D. CONWAY, Secretary.

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CHARLES THOMAS,
Died December 15, 1928.

LATIMER L. ROWLES,
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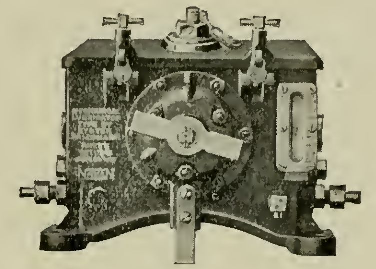

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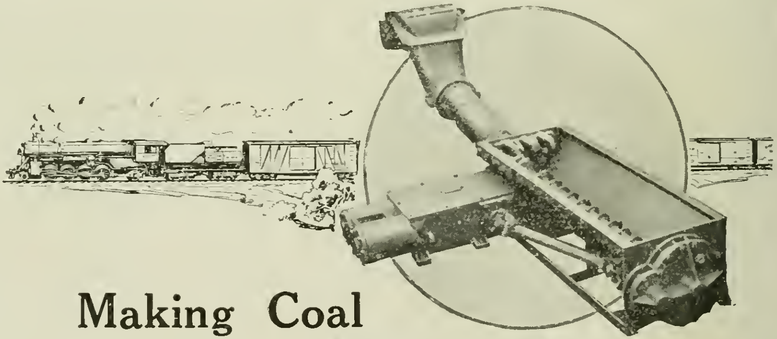

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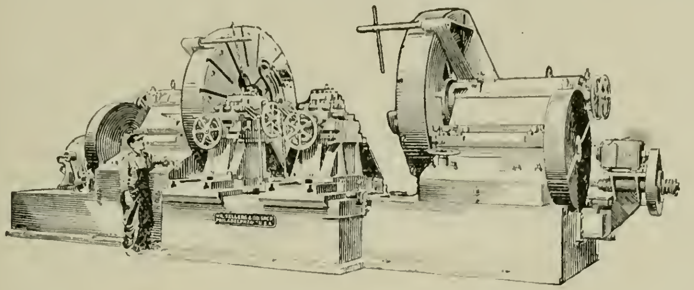

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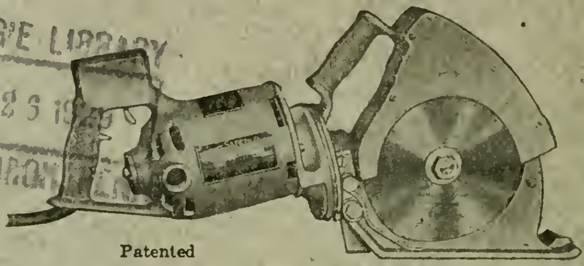

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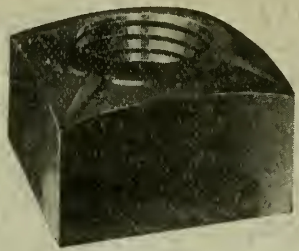

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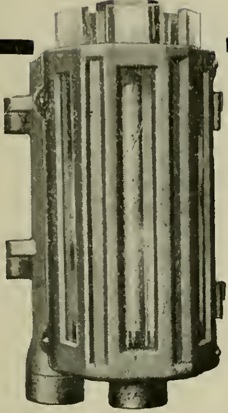

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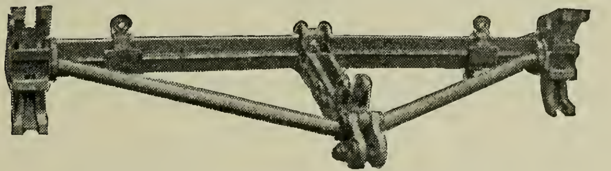

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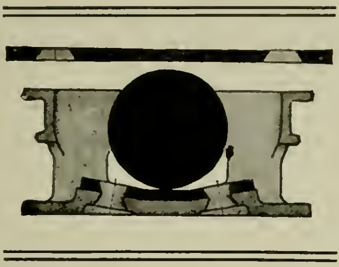

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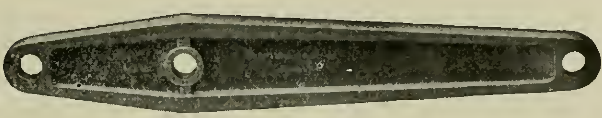

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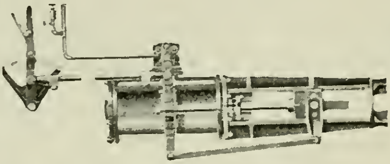

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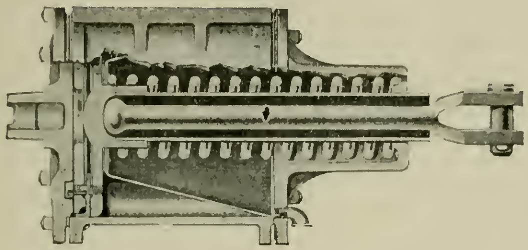

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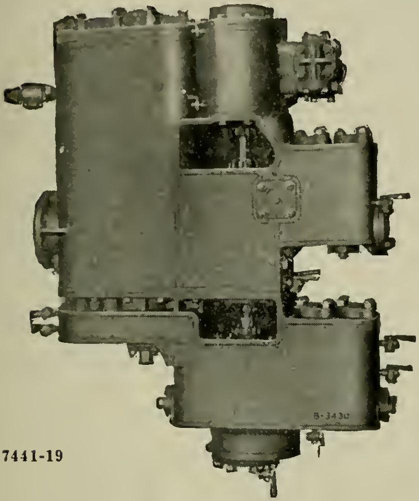

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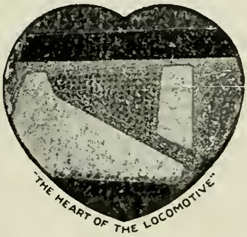

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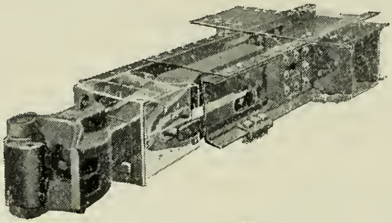

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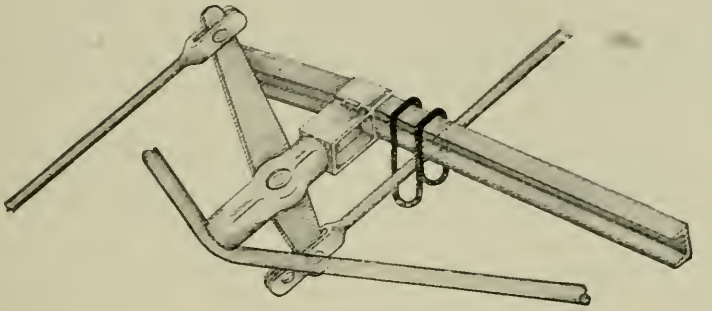

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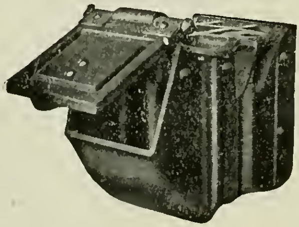

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OF
The Railway Club of Pittsburgh
Organized October 18, 1901

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*J. H. McCONNELL	October, 1901, to October, 1903
L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
*J. A. SPIELMANN	November, 1918, to October, 1919
H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
JANUARY 24, 1929

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

MEMBERS

Allison, John
Altsman, W. H.
Ambrose, W. F.
Anne, G. E.
Bayer, George J.
Beck, C. H.
Berg, Karl
Bier, Edward C.
Binkley, W. E.
Bradley, W. C.
Brinkhoff, W. H.
Burel, W. C.
Campbell, J. T.
Christy, F. X.
Cipro, Thomas
Conway, J. D.
Crawford, D. F.
Dalzell, W. E.
Davis, Charles S.
Diven, J. B.
Earley, J. T.
Edwards, C. H.
Emery, E.
En Dean, J. F.
Endsley, Prof. Louis E.
Evans, David F.
Fendner, W. J.
Fisher, Harry G.
Frauenheim, A. M.
Freshwater, F. H.
Fults, J. H.
Garant, Ernest J.
Gilg, Henry F.
Goda, P. H.
Gorman, Charles
Hackett, C. M.
Hall, Chester C.
Hamilton, William
Hansen, William C.
Hastings, Walter S.
Holmes, E. H.
Hood, J. M.
Hussong, A. C.
Irwin, R. D.
Ketchpel, Paul A.
Kiefer, Fred.
Kummer, Joseph H.
Laird, E. C.
Lanahan, Frank J.
Lanahan, J. S.
Landis, William C.
Lawson, A. F.
Leckey, Ralph F.
Lewis, Herbert
Lobez, P. L.
Long, R. M.
Ludgate, B. A.
Maliphant, C. W.
Miller, C. W.
Miller, John
Morris, J. H.
Myers, Arnold
McAbee, W. S.
McIntyre, R. C.
McKinley, Archie
McNamee, W.
McNelty, A. P.
Ness, H. S.
Oppermann, E. W.
Orchard, Charles
Painter, Joseph
Paisley, F. R.
Prince, Albert
Provost, S. W.
Ralston, J. A.
Rauschart, E. A.
Redding, P. E.
Reeve, George
Roan, H. E.
Rogers, Robert
Sattley, E. C.
Seaman, G. W.

Searles, E. J.
Seiss, W. C.
Severn, A. B.
Shafer, John S.
Sharp, H. W.
Sharp, James
Sheridan, T. F.
Shellenbarger, H. M.
Showalter, Joseph
Stevens, L. V.
Stevens, R. R.
Stilwell, K. E.
Stoehr, Arthur L.
Stoffregen, Louis E.
Strachan, M. B.
Sutherland, Lloyd
Taiclet, J. A.
Taylor, J. M.
Trance, F.
Trautman, Harry J.
Tyrie, R. M.
Vollmer, Karl L.
Walther, G. C.
Waterman, E. H.
Welch, E. M.
Wible, T. E.
Wikander, Oscar R.
Wildin, G. W.
Wolford, Jesse J.
Woodward, Robert
Wright, Edward W.
Wright, John B.
Wright, O. L.
Wynne, F. E.
Wyke, J. W.
Young, F. C.

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Anderson, J. M.
Barnum, Merle
Berkhober, Charles, Jr.
Browne, Bard
Burgham, M. L.
Carruthers, G. R.
Carter, William
Ceadda, Y. A.
Christy, J. A.
Crawford, A. B.
Cudge, Edmund W.
Cumings, D. A.
Davis, William B.
Dawson, H. R.
Dickson, K. B.
Diehl, Richard C.
Emsheimer, Louis
Ferree, J. W.
Hildenbrand, L. B.
Hollis, H. E.
Lewis, S. B.
Leinemann, A. F.
Marble, Robert A.
McCrea, James G.
Oschman, William
Pyne, Frank
Reese, F. T.
Roberts, J. B.
Russell, A. G.
Short, J. E.
Smith, Sion B.
Thomas, H. N.
Vollmer, Walter
Wetzel, James S.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Browne, Bard, Assistant to Vice-President, The Supherheater Company, 17 East 42nd Street, New York, N. Y. Recommended by J. A. Ralston.

Crary, Harry S., General Manager, Fort Pitt Spring Company, P. O. Box 917, Pittsburgh, Pa. Recommended by D. S. Molyneaux.

Lunden, Carl J., Draftsman, P. & L. E. R. R., 267 Fisk Street, Pittsburgh, Pa. Recommended by W. H. Brinkhoff.

Wetzel, James S., Draftsman, Wine Safety Appliance Company, 5646 Rippey Street, Pittsburgh, Pa. Recommended by P. L. Lobez.

PRESIDENT McABEE: These applications will be referred to the Executive Committee in accordance with our By-law, and upon approval by them the gentlemen will become members without further action.

Is there any further business to come before the meeting? If not, we are ready for the paper of the evening, which will be on the subject "Science and Industry," by Dr. E. R. Weidlein, Director of the Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa. I take great pleasure in introducing Dr. Weidlein.

SCIENCE AND INDUSTRY

By DR. E. R. WEIDLEIN,

Director of Mellon Institute of Industrial Research, Pittsburgh, Pa.

Industry is both a being and a becoming; and so is industrial research. Industrial research may be evaluated either from a purely monetary standpoint, both to the industrialist and the scientist but primarily to the industrialist, or from the broader viewpoint of its importance to the community. Even a cursory study of the needs of life and of the foundation upon which civilization, and particularly democratic civilization, is built reveals the fact that science is necessary for progress. It is a component part of the things that civilization, through the centuries, has brought about. It is the hope of the future. Science is the greatest modern creator of new wealth and the greatest practical agency of democracy—the greatest equalizer of our time. As such a creator of new wealth and new resources, science and its continual development vitally affects taxation and the cost of living; first, by creating new wealth to help share the burden, and, secondly, by making the necessities of life constantly better and cheaper.

We are in the first flush of the dawn of the era of science in industry, of a day which is heralded by the vanguard of industrial research laboratories. Industrial research is a comparatively new tool of industry in America. However, the rapid advances that have been made during the last twenty-five years make it necessary to have well organized research establishments to carry on the work. The existence of Mellon Institute today is due to the vision and courage of individuals who clearly forecast the future twenty-two years ago. Its conception came from the mind of the late Dr. Robert Kennedy Duncan, and its development from the courage of the Secretary of the Treasury, the Honorable Andrew W. Mellon, and his brother, Richard Beatty Mellon. It is a pioneer in the field of the co-operation of science with industry.

Science is definable as the accurate knowledge of observed facts and their causes. Research is the effort to obtain knowledge; science, the knowledge obtained. The application of this knowledge is the principal mode for securing human efficiency.

Industry, in its essential sense, is merely the changing of some raw material, some resource of nature, into a form in which mankind can use it. Industrial research, in its widest application, is simply the means of making that process of change as efficient as possible.

It is well to emphasize at this point that modern research may be classed into two main divisions: The first "pure science" or "fundamental" research; the second, "applied" or "industrial" research. The distinction is one of motive. In the past, those devoted to pure research encouraged the impression that pure science, "a sort of preserve for intellectual sportsmen," was esoteric and distinctly apart from the ordinary affairs of life, and made no effort to disclaim the implication that pure scientists necessarily brought to their inquiries a higher and subtler intellect than those who were engaged in applying science to the needs of the community.

This adopted aloofness and lack of sympathy with respect to municipal and industrial practice have undoubtedly been prominent in retarding the solution of a number of the great problems of both chemical and mechanical technology, and have, moreover, acted as a barrier to needed co-operative effort.

It is certain, however, that, with the recent elaborate development of industrial research and the general recognition of the high quality of work which it demands, this view of the relation of pure and applied science has now entirely disappeared. In fact, while pure science ever has been, and ever must be, the safeguard of industrial research—the wellspring of experience and wisdom—it is generally conceded that the industrial investigator always will be the translator of the language of pure science to the manufacturing world, and in many cases, where necessity arises, the originator as well as the applicator of scientific method. Both pure and applied research are of the same order of importance and each has its own related field.

Here again the University of Pittsburgh and Mellon Institute have combined forces into a complete unit. This type of co-operation reduces to a minimum the period represented by time elapsed from the discovery of a principle in science to mass production. The electrical industry, which is based upon the pure science research of Michael Faraday, required nearly a hundred years for its development. Compare with that the development of the radio industry or any of our other modern industries developed during this period of better understanding of co-operation between the pure science research work, the industrial scientist, and the industrialist. Cast your thoughts backward to the condition of the community twenty-five years ago and contrast it with the present state of affairs. What do we find in briefly surveying this space of time? We find numerous industrial and civic improvements of high importance. Communication in every form is more intimate; in fact, distance appears to vanish, our methods of transit becoming superhuman. Science has put a girdle around the earth in forty minutes. Anything that anybody wants to say can be communicated to anybody who wants to hear it anywhere in all the wide world within a few minutes, a few days, or at most a few weeks. In the agencies by which this is accomplished rapid transit by ship, train, automobile, airplane, printing, photography, telegraph or telephone, wired or wireless, chemistry plays an essential role, although it is so unpretentious a part that it often does not receive recognition.

By way of illustration, one of the most important parts of your radio equipment is a chemical product known as "bakelite" or "redmanol", which is manufactured from two common substances, namely, carbolic acid and formaldehyde. Beginning with the discovery of a proper method of controlling the production of these phenol resins, their subsequent hardening under heat and pressure, and their increased strength when fillers are used, particularly fibrous fillers, all this has made possible the application of phenol resins in technology in the widest and most varied manner. It has made possible the rapid and cheap production of distributor heads and rotors for automobile ignition. The accuracy of dimensions with which these phenol resins can be molded and their permanence of shape under elevated temperatures, such as one gets under an automobile hood, has made their application very extensive in the automobile industry. In addition to distributor heads and rotors, coil housings, bells for motors, insulation strips, and punchings of all sorts and varieties are used in the automobile of today. Also, the timing gear in many automobiles is made of laminated canvas-base phenol-resin material.

Phenol resins are rapidly revolutionizing the grinding wheel and waterproof sandpaper industries and bid fair to revolutionize completely the method of oil-well drilling, since carborundum, held together with a phenol resin, cuts through sand many times more rapidly than steel bits.

Some of the more spectacular and less voluminous uses created for phenol-resin products are dentures for false teeth, non-heat producing grinding instruments for the dental trade, glaze for porcelain ornaments, handles on coffee percolators, pencil barrels, and fountain pen barrels, beads, buttons, billiard balls, and pipe stems.

Likewise, the development of the airplane has depended largely upon the chemist. It requires suitable engine fuels and lubricants, chemically-treated textiles for the wings, and, most important of all, magnesium metal for making strong, light, machinable alloys. Magnesium metal is a new industrial product which is lighter and stronger than aluminum. In combination with aluminum to produce an alloy, it has found extensive use in the building trades outside of the field of aeronautics.

New inventions have been an important cause of industrial development. The growth of invention, in fact, is one indication that a nation is becoming better served with the essentials of economic progress, one of which is industrial research. Many inventions are now the product of organized work in research laboratories, where physical and chemical specialists are employed solely to find new materials, new processes, and new uses of products, for industrial development. The most revolutionary inventions have been those in the fields of electricity and chemistry.

In whatever direction one turns these results are apparent, although progress has not been uniform in all industries. Naturally, most attention has been given to the fields of immediate importance.

The rapid development of the automobile has made progress necessary in many other fields. If we stop to think, we shall realize that all the resources of a vast and complex civilization have been called upon to produce it. The motor-car industry not only has taken full advantage of the possibilities of its own research organizations but its spectacular expansion has given impetus to other classes of industrial research, such as petroleum products, rubber, the metals, leather, synthetic fabrics and compounds, as well as road materials.

Until thirty years ago, petroleum was important to civilized man chiefly because it was his main source of light. Kerosene lamps are still widely used in the orient and the other far places of the earth. Here, however, we get our light by more efficient means and use the petroleum to supply another vital need, a fuel for our many automobiles. Studies in the cracking of oil have doubled the available supply of gasoline and promise methods for completely converting crude oil into motor fuel with a little by-product coke. Motor fuels with antiknock properties have been developed. We learn a great deal about the possible exhaustion of our petroleum resources, and this is one of the reasons for the existence of the chemist and the maintenance of the chemical laboratory, to provide for such an emergency. The Germans are now concentrating on the production of heavy oils from coal, and have made sufficient progress to enable them to construct a commercial-size unit, and it is rumored that Germany will be able to produce sufficient motor fuel by next year to meet its own requirements.

The rubber used in the automobile tire has likewise developed some of our largest corporations, and one has only to recall past experiences with an automobile tire with the present to appreciate the advances that have occurred in this industry through the application of science. The service life of tires has been greatly increased, thanks to research on accelerators for vulcanization, on rubber compounding, and on the tire fabrics. The rapid development of the rubber industry is obvious, so let us turn to other fields. How many people realize that the automobile completely revolutionized the paint and varnish industry, due to its requirements for a better finish and one which could be applied in a shorter period of time. The result is the nitrocellulose lacquers, and the development of new synthetic gums and solvents. This, in turn, has created two entirely new industries within the last ten years. One of these industries is located in the corn-belt of Indiana and Illinois. Through scientific research in the field of biochemistry, the corn is treated with a new type of bacillus which produces these necessary lacquer solvents instead of the familiar pre-prohibition solvent, ethyl alcohol. The second of these industries depends upon the common product natural gas for its source of raw material. This industry is especially close to us, as it originated and was developed into being in the laboratories of Mellon Institute. The results of this research have made available in large quantity and at low cost a variety of commercially valuable aliphatic organic chemicals, distinct in origin as well as in application from the synthetic chemical products heretofore generally known.

A principal product of these efforts is ethylene glycol, which has offered to industry for the first time, after having been known since the early days of chemistry only as a chemical curiosity. Ethylene glycol is now widely used in explosives manufacture and as an antifreeze material for automotive engines; it is also finding numerous new uses to supplement the inadequate supplies of glycerol and is further serving purposes entirely new in the arts. The ethers of glycol are ideal solvents for nitro-cellulose lacquers and in the rapidly expanding lacquer industry they are introducing qualities indispensible in their nature.

The pure hydrocarbon constituents of natural hydrocarbon mixtures have also found many valuable and interesting uses. For example, ethane, propane, isobutane, and normal butane have been found to have special physical properties making them desirable as refrigerating gases. Commercial propane, distributed in cylinders, has contributed a form of fuel gas with widespread application in household, laboratory, and factory heating problems. Thus an ever-increasing number of products is being produced from these hydrocarbon raw materials, and it is apparent that an industry of large proportions is in the process of being established on the fundamental or pure research which has been conducted in this field.

Electric illumination, radio, electro-chemical and the telephone are four industries which have developed from their basic inventions to important places in our present industrial organization in a period of less than fifty years. In each there is striking evidence of the inter-relation of the "cycle of research" with the various stages in the development of its industry. It is significant that the time log in the development of these industries has been greatly reduced by systematic scientific research. What happens when research is undertaken in older industries—the iron and steel industries, for example, are of the oldest in recorded history? The steel industry for hundreds if not thousands of years was an art and yet within less than fifty years it has felt the influence of research and has experienced a greater development in that period of five decades than all the centuries that went before.

The problems that are receiving the most attention in Europe at this present time are the nitrogen industry, coal liquefaction, gas supply, dyestuffs and synthetic organic chemicals, principally solvents and textiles, including artificial silk. Most of these problems are related to and depend upon coal or lignite as a raw material. They are producing both synthetic ethyl alcohol, methyl alcohol, organic solvents, and hydrogen for use in the nitrogen fixation process for the production of ammonia, besides dyes, medicinal products, motor fuels, and fertilizers from coal.

The countries of Europe are also combining forces in the development of these various industries. This type of co-operation cannot help but produce results, and yet it is only one part of an effort to gain industrial and independent recognition.

Europe realizes that scientific co-operation is the most powerful means of dealing with many of these difficulties with which it is faced today, and the surest means of self-protection and preservation. This should be equally true of all business enterprises today. The aim of business is profit, and hence it is essential to operate plants with gain. In consequence of this recognition in industry, incumbrances that interfere with advantageous production must be discarded. Waste, inefficiency, senile processes, antiquated plants, and unscientific practices in general are the foes of profitable operation. Effective intelligence service on market conditions, both foreign and domestic, and adequate to technical research on plant production problems are the agencies upon which the dynamic, successful business of today is most dependent.

Strenuous competition such as prevails these days is the factor that most influences progressive change or developmental improvement. It has brought respect for industrial research, simplified practice, efficiency programs and statistics. Paradoxically, associated effort has effected beneficial contact among competitors and has enabled concerted vigilance, fact-finding, and progress in technologic and market research.

It has become a truism to say that scientific research has exercised a profound influence on industry, particularly upon the character and direction of manufacturing methods. It is equally true that industry has had a great influence upon scientific research. By providing opportunities, industry has led to the improvement and extension of research procedures.

Business is being conducted on a wider scale and at greater speed than ever before. This makes it hard for the weak and inefficient manufacturer, but opens a wonderful vista to those who are strong, able, free from the influence of precedent, and appreciative of the possibility of improving on the methods of the past. Modern business is therefore especially receptive respecting the application of science in the correction of production, advertising and sales troubles.

Formerly the voice of the scientist was that of one crying in the wilderness. Now he commands the attention of the man in the street.

PRESIDENT McABEE: When we read the newspapers tomorrow morning and see the announcement of some new development, we will not need to wonder what the world is coming to next. Dr. Weidlein has put some new thoughts into our minds, in his talk, and we might be able to glean a little more from him if some of you gentlemen would ask a few questions, and I am sure he will be very glad to answer them.

MR. CHARLES ORCHARD: A gentleman in St. Louis two or three weeks ago told me that they were turning out news print paper made from corn stalks out in Iowa. Can you tell us what that process is?

DR. WEIDLEIN: That is a new process that was developed at the University of Iowa. It is along lines such as these that can do more for the farmer and for agriculture than all the legislation that can be put into effect. As a result of Iowa being in the corn belt, they have been trying to find a utilization for waste corn stalks. They have worked up a process and are now building a commercial plant of a small size out in Illinois for producing this paper. They have produced a paper and have run off an edition of the local newspaper in the town where the plant is located from this paper produced from corn stalks. There is a book on agriculture that will be printed on it, the first one to be printed on this particular type of paper.

PRESIDENT McABEE: Would any other gentleman like to ask any questions? Professor Endsley?

PROF. L. E. ENSLEY: I do not know that I have anything in particular to ask. I have enjoyed this talk very much. I was located for a good many years in the building next to the headquarters of the Mellon Institute and knew a great many of the men engaged in that work and enjoyed talking with them. And they enjoyed their work.

That is a great work that Dr. Weidlein has laid before us in his talk, and we have all enjoyed it. We are all more or less of a turn of mind to be interested in the every day things of our own line of work, and if, as Dr. Weidlein suggests, we would give a little additional thought to the things we are doing every day we might be able to make the work a little more enjoyable to ourselves and put a little more money in the pocketbook of the company we are working for.

There is one question I would like to ask. In the selection of the men to do this work do you not encounter one of your hardest problems?

DR. WEIDLEIN: That is one of the most difficult jobs we have. Fifty per cent of the success of any investigational work to be tackled will be due to getting the right man in the right place. Scientific men are of a peculiar turn of mind. They are rather difficult to handle and you have to take into account all these idiosyncracies if you are to get the best out of them. It is not a question of problems. We have problems by the wholesale. One of the great difficulties is to get well trained men for the particular type of work. We require men of strong personality as well as men with proper background in their particular science, because they are going to come in contact with business men, and they have to be men that can meet that particular situation, and diplomacy is a very important aspect in this type of work.

At the present time our men come from 86 different universities in the United States—to show the broad scope of our selection of men.

PRESIDENT McABEE: We would like to hear from our Past-president, Mr. Frank J. Lanahan.

MR. FRANK J. LANAHAN: This has been a very interesting, instructive and educational talk. I am very much impressed with the truth of the old saying that "perfection is made up of trifles, but perfection itself is no trifle." The very great variety of subjects touched upon by the speaker—oils, paints, building materials, alloys, food, yeast, bread, plants, smoke, denatured alcohol, even to the humble but popular "hot dog"—certainly shows a wide range, with a remarkable ability to give a thoroughly intelligent understanding, in language so simple that even a child could comprehend. I think our Secretary was entirely justified in sending out on the notice for the meeting, the statement that "The Doctor is a well known and a gifted speaker, thoroughly versed on the subject." It is a matter of particular satisfaction to all of us to realize that this Institute which he so ably represents, is a Pittsburgh product. Dr. Weidlein says it originally came from the great open spaces of the West, but Pittsburgh has nourished it and developed it to its present high standard. Pittsburgh appreciates this class of research work and has encouraged it.

I could not help but feel when Dr. Weidlein spoke of the difficulties in the selection of individuals to head the various activities in the research field, that the founders and financial backers of the Mellon Institute, were most fortunate in their choice of the chief executive, for results demonstrate the wisdom of their preference.

May I, Mr. President, move you on behalf of the Railway Club of Pittsburgh that a rising vote of thanks be extended to Dr. Weidlein in appreciation of his most interesting and educational talk?

The motion prevailed by unanimous rising vote.

DR. WEIDLEIN: Mr. President, I thank you for the opportunity of being here.

ON MOTION adjourned.

J. D. CONWAY, Secretary.

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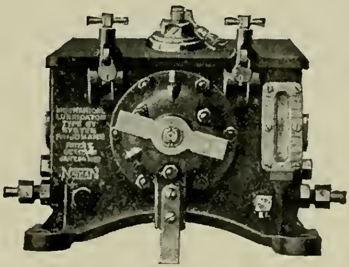

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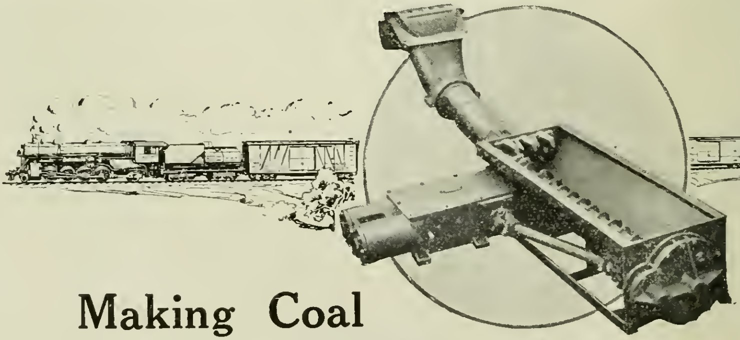

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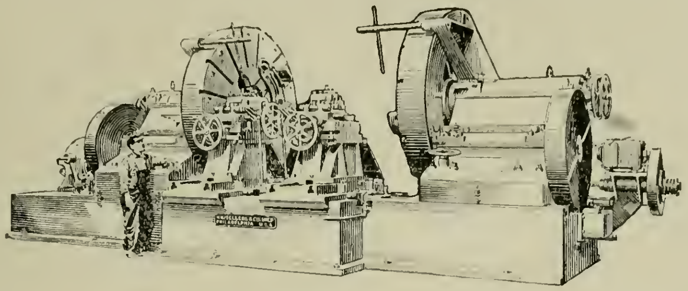

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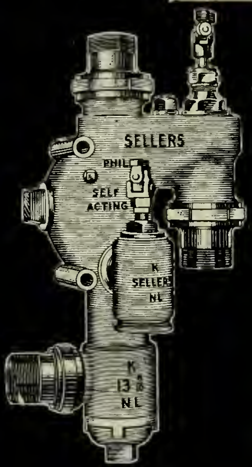

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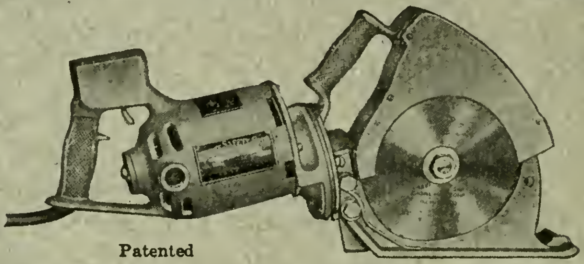

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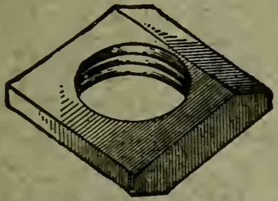

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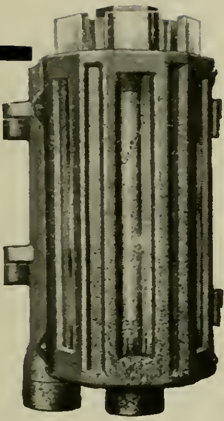

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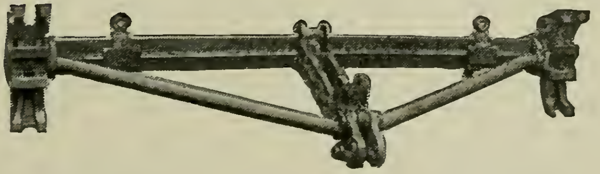

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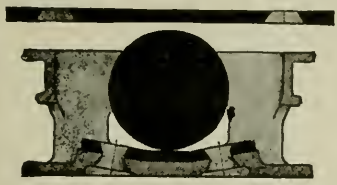

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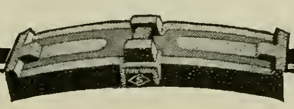

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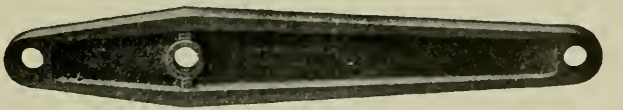

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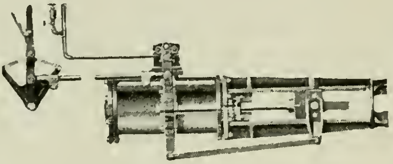

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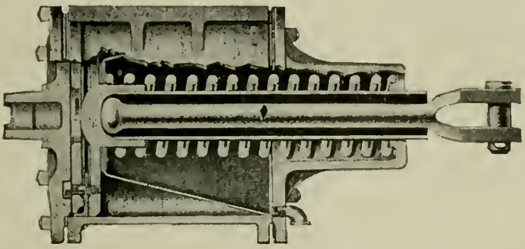

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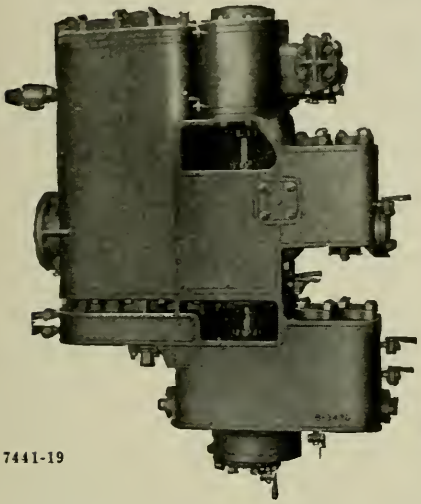

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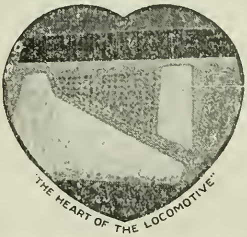
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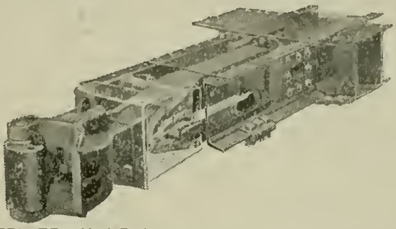

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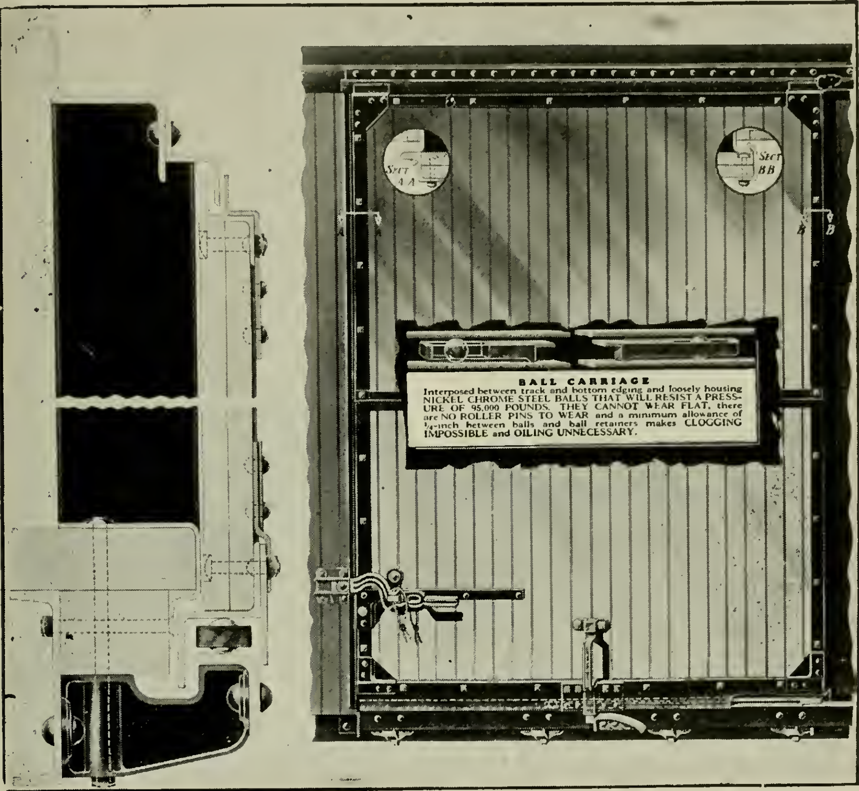

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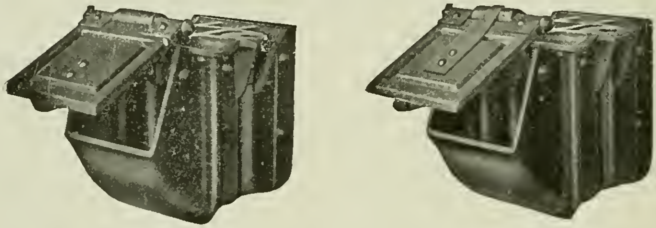

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No. 4.
Pittsburgh, Pa., Feb. 28, 1929.
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25c Per Copy

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G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

February 28, 1929

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

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Berghane, A. L.
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Cotter, G. L.
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Davis, Charles S.
Edwards, C. H.
Emerick, J. B.
Emery, E.
End Dean, J. F.
Farfan, Robert F.
Fendner, W. J.
Fisher, J. J.
Fletcher, Albert
Freshwater, F. H.
Fults, I. H.
Gilg, Henry F.
Goda, P. H.
Gordon, G. A.
Hall, Chester
Haller, Nelson M.
Hamilton, William
Heinlein, George J.
Holmes, E. H.
Hoover, J. W.
Hughes, J. E.
Johnson, E. A.
Katchpel, Paul A.
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Muir, R. Y.
McAbee, W. S.
McGaw, William L.
McGeorge, D. W.
McHugh, C. A.
McIntyre, R. C.
McKinley, Archie
McLaughlin, H. B.
McMillan, A. P.
McNamee, W.
McNelty, A. P.
Nelson, W. M.
Ness, H. S.
Noble, J. A.
Painter, Joseph
Paisley, F. R.
Passino, F. J.
Paul, Lesley C.
Peterson, E. J.
Posteraro, S. F.
Rabold, W. E.
Ralston, J. A.

Rauschart, E. A.
Read, A. A.
Reddick, Warren E.
Redding, R. D.
Reese, O. P.
Rizzo, C. M.
Rogers, Robert
Rushneck, G. L.
Sample, W. E.
Sanfillip, P. C.
Sattley, E. C.
Seiss, W. C.
Semethy, J.
Seroky, Edward A.
Shafer, John S.
Sharp, James
Shellenbarger, H. M.
Shelton F. M.
Showalter, Joseph
Shriver, W. W
Simons, P.
Smith, H. K.
Smith, R. W.
Sterling, C. C.
Stevens, R. R.
Strachan, M. B.
Sutherland, Lloyd
Trance, F.
Trautman, Harry J.
Tyrie, R. M.
Van Blarcom, W. C.
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Verret, Roy H.
Walther, G. C.
Warfel, John A.
Warner, Russell H.
Wheatley, William
Wheeler, C. M.
Wikander, Oscar R.
Woodward, Robert
Wright, O. L.
Wurts, T. C.
Wyke, J. W.

VISITORS

Bair, J. K.
Baker, J. B.
Barr, S. T.
Beach, M.
Braithwaite, Geo. L.
Brown, Homer
Carothers, William D.
Carruthers, G. R.
Costes, W. T.
Cox, A. M.
Cudge, Edmund W., Jr.
Darrall, William G.
Davis, J. E.
Dawson, H. R.
Descamp, J.
Finn, Thomas A.
Frazee, G. L.
Gable, Harry R.
Gable, M. G.
Gabriel, E. J.
Garraghty, W. C.
Gollmer, H. C.
Gray, R. H.
Hardman, Willard M.
Hartman, F. C.
Hibner, A. J.
Horton, H. R.
Johnson, Bert
Kane, H. S.
Kifer, C. K.
Kromer, N. W.
Kuehna, A. G.
Kusserow, Fred W.
Leck, A. H.
Lewis, S. B.
Llewellyn, Thomas J.
Marquis, J. M.
Miller, Geo. P.
Murray, E. A., Jr.
McCrea, J. G.
McDonald, John A.
McMaster, S. E.
Nuyshey, H. L.
Oschman, William
Plant, L. G.
Scherwinka, Max
Schmitt, Raymond F.
Schrontz, S. B.
Shore, J. E.
Sichler, C. N.
Smith, Charles K.
Thomas, H. N.

Warmington, Robert
Welten, S. A.
Whitehill, D. W.
Williams, E. R.
Wolfe, Ralph
Wolpert, R. E.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Bair, J. K., Locomotive Engineer, Union Railroad Company, 139 Brown Avenue, Turtle Creek, Pa. Recommended by J. W. Wyke.

Bowers, John M., Clerk, Union Railroad Company, 1203 Swissvale Avenue, Wilkinsburg, Pa. Recommended by W. S. McAbee.

Cox, Alfred M., President, Pittsburgh Commercial Heat Treating Company, 1374 Marlboro Avenue, Wilkinsburg, Pa. Recommended by D. S. Molyneaux.

Crispen, Raymond B., Timekeeper, Union Railroad Company, 420 South Avenue, Wilkinsburg, Pa. Recommended by W. C. Bradley and W. S. McAbee.

Descamp, J., Car Inspector, Union Railroad Co., 514 Watson Street, Hays, Pa. Recommended by J. J. Fisher.

Edgin, George A., Assistant General Manager, The Duff-Norton Manufacturing Company, P. O. Box 555, N. S., Pittsburgh, Pa. Recommended by O. L. Wright.

Evans, E., Locomotive Engineer, Union Railroad Company, Fourth Street, Braddock, Pa. Recommended by J. W. Wyke.

Fischer, G. E., Clerk, Union Railroad Company, 2202 Hampton Street, Swissvale, Pa. Recommended by W. C. Bradley and W. S. McAbee.

Gabriel, E. J., Asst. Round House Foreman, Union Railroad Co., Church Hill Road, Box 513, Turtle Creek, Pa. Recommended by J. W. Wyke.

Glessner, George P., Wrecker Engineer, Union Railroad Co., R. D. No. 1, Turtle Creek, Pa. Recommended by C. C. Sterling.

Harbaugh, Charles P., Wreck Master, Union Railroad Co., East Pittsburgh, Pa. Recommended by A. F. Coulter.

Jack, R. Ralph, Assistant Paymaster, Union Railroad Co., 51 Haslett Avenue, Lincoln Place, Pa. Recommended by W. C. Bradley and W. S. McAbee.

Linsenbigler, Allen J., Gang Foreman, Union Railroad Co., 212 Dixon Avenue, East Pittsburgh, Pa. Recommended by John J. Fisher and W. S. McAbee.

Mitchell, J. G., Sub-Storekeeper, Union Railroad Co., 3 Duquesne Boulevard, Duquesne, Pa. Recommended by J. J. Fisher and W. S. McAbee.

MoCready, Arthur, Gang Foreman, Union Railroad Company, 547 Ninth Avenue, Munhall, Pa. Recommended by John J. Fisher and W. S. McAbee.

McDonald, John A., Clerk, P. & L. E. R. R., 119 Carson Street, S. S., Pittsburgh, Pa. Recommended by P. C. Sanfillip.

McGinley, T. A., President, The Duff-Norton Manufacturing Company, P. O. Box 555, N. S., Pittsburgh, Pa. Recommended by O. L. Wright.

Ragner, George O., Secretary, Beck, Riley & Hall Equipment Co., 458 Union Trust Building, Pittsburgh, Pa. Recommended by A. E. Herrold.

Schiller, William B., Jr., Secretary-Treasurer, Standard Auto-Tite Joints Company, 1005 Park Building, Pittsburgh, Pa. Recommended by Henry F. Gilg.

Seewald, David James, Clerk, Union Railroad Company, 1453 Marlboro Avenue, Wilkinsburg, Pa. Recommended by J. J. Fisher.

Smith, J. Frank, Gang Foreman, Union Railroad Co., 141 Brown Avenue, Turtle Creek, Pa. Recommended by John J. Fisher and W. S. McAbee.

Stanford, E. R., Service Engineer, The Superheater Company, 15 Dorchester Road, Buffalo, N. Y. Recommended by R. H. Flinn.

Trainer, M. N., Asst. Vice President, The American Brake Shoe & Foundry Company, 30 Church Street, New York, N. Y. Recommended by J. A. Ralston.

Webb, E. M., General Manager, The Duff-Norton Manufacturing Company, P. O. Box 555, N. S., Pittsburgh, Pa. Recommended by O. L. Wright.

PRESIDENT. These applications will be referred to the Executive Committee in accordance with our By-Laws, and upon approval by them the gentlemen will become members without further action.

Gentlemen, we are to have as a speaker this evening, Mr. S. E. McMaster of the Pennsylvania Railroad, who is going to speak on the subject, "Aviation as it Affects the Railroads." Mr. McMaster has made a very thorough study of aviation from all of its different angles, and is prepared to talk in detail to you. This address will be especially interesting to all of us, due to the consideration which is now being given for an up-to-date airport for commercial purposes in our own vicinity. Mr. Master:

AVIATION AS IT AFFECTS THE RAILROADS

By S. E. McMASTER, Supervising Agent, Pennsylvania Railroad Company, Captain, Corps of Engineers, U. S. Army-Reserve, Altoona, Pa.

MR. PRESIDENT, MEMBERS OF RAILWAY CLUB OF PITTSBURGH AND GUESTS: When you did me the honor of inviting me to come here to address you I hesitated because I realized that it would be very hard for me to measure up to an audience such as composes the Railway Club of Pittsburgh; an audience composed of so many experts in their line, however, your speaker is deeply interested in this subject from more than one angle; has given much thought and study to it, therefore, concluded that perhaps by coming here might in some small measure forward the interests of the cause with which all are more or less concerned.

I am happy to be with you. Just now I am not unlike an Aviator Friend of mine to whom a young lady said: "It must be great to fly! I should think that you would be as happy as a king when you are in the air." He said: "I'm happier—I'm an Ace! Now, right at the outset I want you to understand that I am not an ace, however, I assume that I have all of the qualifications, except the experience. A Spanish Toreador said a little while ago that he thought that Colonel Lindbergh would make a great Bull Fighter. Now, I would say that in view of Col. Lindbergh's proven marvelous resistance to "Bull" he already is one and if those are the qualifications your speaker enjoys them.

As you probably all know, the first flight of man in a heavier-than-air machine took place a little more than a quarter of a century ago or, to be exact, on December 17, 1903, when The Wright Brothers made that wonderful flight at Kitty Hawk, N. C. From that time until the advent of the World War progress was made rather slowly. The World War did more to give aviation impetus than any other activity or time. Subsequent to the World War aviation went through the Gypsy Stage but the Pioneering Days of aviation were over when Colonel Lindbergh made his epochal flight to France in May, 1927. Since that time aviation has "zoomed" up into an industry which the U. S. Department of Commerce estimates has now more than $100,000,000 invested, however, the aviation industry is still at a point where all of its branches could be included in the capital and physical investment of a single unit of the Steel Industry; the Railroad Industry; a Public Utility Industry, or half a dozen other branches of trade and commerce.

A great handicap of aviation is that there has never been an industry that has made so much noise or that has had more attention from the press and the people alike or that has been forced to carry its affairs so completely in the limelight. On the one hand we have the press giving front page prominence to all of the successes of the industry and that same prominence to all of the fatalities and troubles. This has resulted in false conceptions as to its present status.

The success of air as a transport agency depends primarily, of course, on the service that it can render in comparison with other means of transportation, that is, air lines must show a certain definite advantage such as greater speed, greater comfort and convenience, better travel connections, more scenery and a more enjoyable mode of travel if it is to attract business. At the same time it must meet a public demand for safety and reliability and the charges must be economical from the standpoint of the service that it renders. In order that air service may meet these requirements and thus render to society a full measure of service, it is absolutely necessary that the air-craft must be operated under certain very definite rules not unlike those of our railroad, for example, it must be on regular schedule day and night and through all kinds and vicissitudes of weather. To this end the United States Government through the medium of the Department of Commerce has established a System of National Airways extending from Coast to Coast and from the Great Lakes to the Gulf of Mexico.

Lighting the Airways

The first essential to make this system of Airways valuable was that they be lighted from end to end. A stupendous task, one would say on first thought, however, it was accomplished by placing what is known as the Standard Revolving Search-light Beacons at approximate ten (10) mile intervals over the entire length of the airways. These beacons sweep a huge incandescent finger of light six (6) times completely around the horizon every minute in the form of a 24″ beam of 2,000,000 candle power intensity. These beacons are mounted on fifty-foot steel galvanized towers are visible from the air on clear nights at from 25 to 40 miles. To the "boys" these beacons are the "midnight suns" of the airways. In laying out the air ways it was discovered that the phenomenon of fog, so prevalent in these Alleghenies, did not occur simultaneously in the mountain tops and in the valleys, so they endeavored to alternate the beacons between bottoms and summits with the idea that one or the other would always be visible and that alternate beacons would be quite sufficient to fly by, however, when the clouds begin where the fog leaves off that nullifies the whole plan.

At points where commercial current is available these beacons are made automatic in their operation. Each is provided with a sun relay or sun switch which turns on the light at sunset; starts the beacon revolving and turns it off again at daybreak. Where commercial current is not available small engine driven generating sets are used. These are, of course, operated under the attention of a care-taker whole or part time as may be required.

In order to provide against burning out of these lamps and thus insure continuity of service a simple little instrument, known as the automatic lamp changer, is used. When one of the lamps burn out the current is automatically shunted into the device giving it impulse pulling another lamp into focus and the service thus goes on without interruption.

The Boundary Lighted Intermediate Landing Fields

At approximate thirty-mile intervals throughout the length of the airways are established what is known as **the boundary lighted intermediate landing fields.** These fields are so laid out as to provide two runways at approximate right angles to each other. These fields must have a minimum length of 1,800 feet and a minimum width of 400 feet. At or near a corner of these fields is one of the revolving search-light beacons that I have mentioned. The boundaries of these fields are outlined throughout the hours of the night by a series of boundary lights spaced on 250 ft. centres. This standard spacing is used in order that a pilot not familiar with the field can determine at a glance what area he has to figure out. Ordinarily white lights are used on these spacing posts, except that green lights are used to mark the best avenues of approach while red lights are used to mark those avenues rendered unsafe by obstacles such as high-tension lines, trees, windmills, aerial towers, etc. A wind cone or wind indicator is always found on the hanger; at night it is shown with light to enable the pilot to check his landing approach into the wind.

Charting the Airways

It was also found necessary to Chart the airways and map the airports and landing fields. This work was inaugurated some years ago by the Army Corps of Engineers with the co-operation of the Army Air Corps and is now being handled by the Coast and Geodetic Survey of the Bureau of the Department of Commerce who have for so many years supplied our Marine Navigation Charts. They formerly used the large regulation size but they could not be properly handled by pilots in flight so they divined the strip map or chart for every leg of a route. These maps show route information on the front in seven colors, etc., with sketch plan of the air-ports and landing fields; data concerning their facilities; distances in nautical miles, and key to strip maps on back.

The Weather Bureau

The Weather Bureau of the U. S. Department of Agriculture, under provisions of the Air Commerce Act of 1926, is extending to avigation a very helpful service in sending out over the airways special meterological information. Ground communications, radio telephone and telegraph are used to keep all points advised.

Radio Beacon for Guiding Aircraft

Another aid to avigation and one that is meeting with a very hearty response is the radio beacon for guiding aircraft through fogs, storms, or other conditions of poor visibility. The Army and Navy Air Corps co-operating with the Bureau of Standards have brought it to a state of practical development. In our vernacular it may be said that the Beacon sends out a double-directive radio beam. This beam is, of course, invisible to the naked eye; being received on two small lamps on the instrument board of the plane. So long as the pilot keeps directly on his course he notes these two lamps burning with equal intensity. Should he deviate to the right of the course the right hand light will begin to grow dim and will go entirely out if he gets entirely off his course ;the same on the left, therefore, it may be said that it not only keeps him on his course but guides him back in case he strays, for example, if you were flying the course day or night and noted a storm ahead, you might take your choice of going to the right or the left, or taking altitude and probably avoid the storm, but regardless of what you did the beacon would function just the same and would guide you back when you were ready to regain the course.

A Radio Mile Post

The Bureau of Standards has about completed what might be termed a Radio Mile Post. It is a small type of radio sending station to be installed at each of the thirty-mile landing fields. Each station gives off its own characteristic signal continuously. As the pilot flies his course, being kept there by the radio beacon, he has his head phones over his ears and hears the number of the nearest field repeated over and over. In this way he can keep track of his progress day or night.

Two-Way Radio Telephone

A two-way radio telephone is being perfected in connection with these two instruments. It makes direct communication possible between the pilots in flight and the air-ports. The pilot may thus report his progress; his trouble; the time of his arrival, while the air-port may give him new directions or additional weather reports. I apprehend that this is the future Block Signal System of the airways and that every common-carrier plane will shortly be required to be so equipped.

The Pitch and Bank Indicator and the Inclinometer

A device that has done much for the success of many flights is the Pitch and Bank Indicator and the Inclinometer. To make this very concise; no pilot has ever been known who could maintain his ship on an accepted keel or position for a long continued period of time when in blind flight. This is due to the fact that a pilot has but three senses which he can use while in the air. The names of this "trinity sense" is: Sight, touch or muscle sense and the vestibular or inner ear. When the earth beneath him and the sky above him are out of sight it amounts to the equivalent of being blind-folded. Moreover, experiments have shown that the muscle sense does not function normally when removed from those environs responsible for it, viz: old mother earth which leaves only the vestibular which is not sufficient, therefore, this dual device was perfected which is naught but cross tubes on the instrument board which indicates whether the wings are level or whether it is climbing or nosing down.

The Jones-Baran Chair in which the Army pilots are tested is a device in which one is seated and then turned around on a pivot after being blind-folded. If you were now seated in that chair and turned around to the right for a short period of time and stopped your sensation would be that of turning to the left. If you were then turned to the left for a short period of time and stopped your sensation would be that of turning to the right. If you were then turned to the right for such a period of time that your body action and that of your vestibular were co-incident and then turned more slowly or stopped, your sensation would be that of again turning to the left, with the added sensation of falling. When you were stricken with those sensations a true state of vertigo would have been produced upon you, and every normal human being reacts to it in the same way. The sensations of vertigo are always opposed to that of the movement. There are many tragic stories with which I might illustrate but one is sufficient. It is the story of Captain "Bill" Erwin and his Navigator Alvin Eichwald who were entered to fly the Dole Races across the Pacific Ocean in 1927. They took off regularly but developed engine trouble when about 150 miles from the California coast. They returned to the point of starting and were declared out of the race. They had their engine tuned up that day and the next day volunteered to go to look for other Dole Flyers known to be lost. From the time they left the air-port until they were about 750 miles out over the Pacific the airport was in constant radio communication with them, and they had reported that the air elements were terribly disturbed, moreover that there was a dense fog. Finally, the air-port heard: "We are in a tail spin." Then: "We have come out of it." Then: "We are in ano——" and that letter "o" of presumably the word another (tail spin) is the last that was ever heard of the Dallas Spirit and her gallant crew. Those boys who were listening in on the mainland and have been through the mill themselves have deduced just what happened to them, i.e., that they were turned about for a long continued period of time until the sensations of vertigo had assailed Captain Erwin, when he, possibly feeling that he was falling and at the same time turning to the left further aggravated that actual right turn by putting on right rudder and putting the machine into a climb to overcome the falling, with the result that they went into a right spiral "stall" which is the time when they thought they came out of it and so reported. Immediately, however, the opposing sensations assailed Captain Irwin and he put on left rudder; nosed it down to overcome the lift he felt and virtually flew into the Pacific Ocean. Unfortunately many good men are lost for science. The result of their loss is that pilots have learned that they cannot depend on their senses; that to make a success of it the pilot must believe implicitly in the accurary of the devices before him and not take cognizance of any impressions he may register; which takes genuine willpower because those sensations are most realistic.

The Lesson Learned Through the Tragic Accident to Pilot Ames

Many times the loss of good men promotes safety for others. We have in mind the case of Air-Mail Pilot Charles Ames who virtually flew into the side of Nittany Mountain, near Bellefonte, Pa., several years ago, and was not found for more than a week, as you may recall. It was found that he had struck approximately 200 feet from the crest. The investigation developed that he had set his altimeter for 2,400 feet, which is 200 feet higher than Nittany Mountain, before he left Hadley Field that night. Naturally, this altimeter was set on the basis of the barometric pressure obtaining in the New York District at the time. However, the investigation developed that the pressure at Bellefonte that night was .4 of a point lower than that at his point of starting. That instrument was calibrated that one point equalled 1,000 feet which made him fly 400 feet lower than his instrument showed. Those altimeters are now set on the basis of the lowest barometric pressure obtaining at any point along the route.

The Internal Combustion Engine

Mechanical flight at the beginning of this century would have been impossible without the internal combustion engine because the engines of that day, just as the automobile engine of this day, was useless because of its excessive weight. The first engine that Wright Brothers considered using, we are told, weighed approximately 20 lbs. per H.P. The first engine used was a 4 cyl., water cooled, with a 4 in. bore and a 4 in.

stroke and developed 16 H.P. at 1,200 R.P.M., and weighed 12½ lbs. per H.P. Until the time of the war little progress was made beyond that, however, at the beginning of the World War the average airplane engine developed about 100 H.P. and weighed from four to five pounds per H. P. but the demand for high performance for military planes caused a rapid increase in the power output accompanied by a steady decrease in the weight per H.P. Since the war there has been a continued increase in the size and speed of engines accompanied by some decrease in the weight.

The Air-Cooled Engine

The post-war period has been distinguished by the development of a successful air-cooled aviation engine; the reliability of which it is fair to say made possible many glorious flights. The air-cooled engine established a new scale of weight for aircraft engines and only most intensive development has enabled the water-cooled engine to keep pace and that only in the higher H.P.'s. A modern commercial air-cooled engine probably weighs approximately 1½ lbs. per H.P., while both air and water-cooled engines used for racing purposes approximate close to ¾ lb. per H. P.

The Diesel Engine

As in all other fields of aeronautics, engine development has great future possibilities. The Diesel and other types of Heavy Fuel engines are being experimented with and some of them have been flying with great success. The development of the heavy fuel engine may well prove another step in the progress of aircraft engines.

The Propeller

The engine is not the only aircraft problem; another is the design and proper construction and metal for an efficient propeller. Wright Brothers were the first to develop the theory of the air-screw propeller. Much progress has been made in the design and construction; great knowledge has been gained on the theory of air-screws, however, it is apparent that there is still much that may be accomplished.

Research

The real problems under research at the present time are: Decreased weight in engine construction; increased propeller efficiency; reduction of air resistance or "drag" in plane construction by proper stream lining and the production of stronger and lighter structures. While this is being done it is well to bear in mind that air-travel will probably be based on these features in their order: Safety, Speed, Comfort and Economy and right now manufacturers developing commercial planes are putting forth their best efforts toward supplying greater comfort with decreased weight; not losing sight of the whole question of the economics of air transporation.

The Guggenheim Fund for the Promotion of Aeronautics

The Daniel Guggenheim Fund for the Promotion of Aeronautics, of which Harry F. Guggenheim is the President, has done much for aviation and will doubtless do more in the future. As far back as 1920 automatic stabilization was pretty thoroughly developed. This was followed by mechanical stabilizing devices; one of the principal features being slotted wings and stabilization by advanced wing design, and it is my prophecy that the future holds still greater advancement in store along this line. As far back as 1922 radio control of aircraft was a proven thing, therefore, if any of us live to see another war we will probably find planes sent out sans pilots; controlled by radio to gas and bomb the enemy and the important cities and centers.

This Fund has promoted Roof Markings, in which the industry has co-operated, by a nation-wide campaign which will identify the towns of our country to the aviator. Such identification is the first requisite for an air transportation system which will increase the efficiency of American business by swifter means of communication. The Fund describes the type of roof most suitable for the marking; one of which is the use of blocked letters in chrome yellow on a black background. They stipulate that the letters shall be from ten to twenty feet in height on roofs preferably of tile, shingles, tin or slate and where the visibility will not be reduced by smoke, also, that beside the name of the town the marking should include an arrow pointing to the north with the letter "N" over it and a small letter indicating the airport if there is one in such town.

Research to Overcome Fog

The Fund has fostered great research to overcome fog. Many methods have been tried principal of which is the use of magnetized sand, chemicals, vapors, etc., however, research in the way of overcoming the fog is now practically abandoned and the efforts have been directed toward the use of radio principles in informing the pilot, and to a great extent controlling the plane in fogs. The use of underground cables radiating out from the airports or landing fields, which they hope to develop to the point where a pilot may judge his altitude by a whine, as it were—the first use that has ever been developed for that terrible screech that you sometimes experienced from regenerative sets—also a development along this line which will enable him to record impulses which will locate the field.

The Recent Feat of the Question Mark

To many, the recent feat of the Question Mark in California, in which a great record was made was simply a "stunt" which the Army Air Service performed because they probably had nothing else to do, however, it was a really remarkable accomplishment, in that it demonstrated, beyond the pale of doubt, the feasibility of re-fueling in the air and that means that long trips will be possible with a comparatively small fuel load. This will serve to increase the pay load, and we prophesy that it will make for great progress in the future, moreover, it will make it safer to take off a craft which is not burdened with a superfluos fuel load.

No Great Change in Original Design

As previously explained in detail; one of the fundamentals of the economics of transportation is keeping the "dead-weight" down in proportion to the pay load. I neglected to mention that there is practically no change in the original design as conceived by the Wright Brothers. The greatest departure from the Wright design is the Auto-Gyro recently invented by a Spaniard, Senor Civera, of which you have doubtless read. It has some apparent advantages; it may serve as a "jitney" so to speak; to transport from your home to the airport, or, it may become the competitor of the automobile because to come into universal use the plane must be reasonably "fool-proof" and must be made to rise straight up and land straight down. Decide this yourself, I ask: Would you own an automobile if you had to house it outside the city; the answer is obvious.

Progress

Since all of the things which I have mentioned, and many others, have been perfected and since the spectacular flights of Lindbergh, Byrd, Chamberlain, Maitland and Hegenberger, Captain Kingsford-Smith and many others air travel has advanced more than ten years, relatively speaking. Flying fields have sprung up all over the country with mushroom rapidity, there being on January 1st, this year, 1,324 fair or better rated fields in the United States; 260 of which are along Pennsylvania Railroad Right-of-Way, and new ones are being laid out at the rate of approximately 75 per month. In most cases these fields are equipped with small planes carrying up to eight passengers. They serve a real educational purpose in giving the people a chance to make their first or their fiftieth hop for several dollars a hop.

The Public Not Satisfied With Flying Around Home Community

But the public, as usual, is not satisfied with flying around the home community; they want to use the airplane for travel and the demand became so pressing that the Mail Contractors were finally compelled to carry passengers with their mail. For several reasons they entered the field reluctantly because transporting the mail is a business in itself and just recently taken over from Government Operation. The fact of the matter is the mail contractors do not want the passengers; they have trouble enough in sticking to their schedules without the added risk and responsibility of carrying passengers, moreover, if there is the slightest risk of heavy weather ahead the passengers must be landed to continue their journey by train or automobile, whereas the pilot flying with the mail alone goes on with little regard for the weather so that to them the passengers are somewhat of a nuisance.

Americans will fly if they are offered proper service and reasonably comfortable equipment. This is proven by the fact that the major portion of the patronage of the European Lines is American Tourists. People of every age and the youth in particular are enthusiastic about flying, and flying, don't you know, fits effectively into the pitch and speed of our everyday life and fortunately we are a people who can afford to pay for that speed and novelty. The magnificent distances of our country tends itself to a great aviation development; the interdependence of the cities; the unhampered rights of the air without regard for boundaries, as is the case in Europe, all points out the way.

The Transcontinental Air Transport, Inc.

And now, The Pennsylvania Railroad has gone into the aviation business because the Management believes that the time is ripe for the transportation of passengers by air. We did not just discover aviation a few months ago, or at the time the T. A. T. was formed by The Pennsylavnia Railroad, The Curtis Company, The Wright Aeronautical Company, a powerful banking interest headed by Blair & Co., Inc., of New York City and The Atchison, Topeka & Sante Fe Railroad Company.

Without having one dollar of direct interest, our Company aided in the formation of the Mail Carriers by air. As you know, we carry mails but we welcomed anything that would carry mails more quickly, therefore, gave the greatest co-operation possible. The Air-Mail Contractors are stock companies backed by men who are willing to give support up to a certain sum without any thought of return. There was no profit in their stock. There is none today. Then, if all this be true, what is in the plan; why do they so invest? As I stand before you, gentlemen, they are in it out of sheer patriotism. Mark that word. I mean just that: "Patriotism" and not profit or gain as some contend. Those men are the "Defenders of Our Nation" though they took no credit for it. They are in it because "War Aces" must have an industry back of them; because the development of our commercial aviation is essential to the military defense of Our Country.

Again, we are in it because Aviation is becoming less and less of an imponderable; it is now a proven thing. First: We have developed flying equipment. Second: We have the flying experience fully developed on the Air-Mail Lines. Third: We have the requisite fields which are constantly being increased and improved. Fourth and finally: We have an Air-Minded Public who now want to become Air Conscious.

While we make no claims to having formulated all of its elements; this new company is being managed by "air experts" and not rail experts. These men will make air decisions and not rail decisions as I can prove to you. The Curtis people are interested in T. A. T. The first planes were ordered from Ford. Charles L. Lawrence, head of the Wright Company is a Director of T. A. T., and Wright Whirlwind motors have been standard equipment in many Ford-Stout all-metal planes but T. A. T. demanded a higher cruising speed—more power, so that Pratt & Whitney "Wasp" replaced the Whirlwind engines in the T. A. T. planes ordered. With decisions like this being made we think we prove that they are putting Safety and considerations of Efficiency first. Incidentally, I might mention that this first order is for ten planes to cost $800,000 and it has been said, I presume on good authority, that The Ford Company will lose approximately one-quarter of a million dollars on this initial order.

Our Chicago-Twin Cities Route, which was started on September 1st, 1928, is operated by the North-West Airways, Inc., a subsidiary of the T. A. T. The use of this service makes a nice saving of time on a trip between the east and the Twin Cities, or for train connections for the Northwest at the Twin Cities. We pridefully commend it to you. Our Route between Columbus and the Coast will commence operation; to use the language of Mr. C. M. Keys, the President of T. A. T., when we are properly ready. This statement is made this way because it is entirely too early to establish a definite date for the starting of the operation.

The Rates That Are Charged

Practically all of the mail contractors charge an average of 10 cents per mile, and have since they started. The only exception to this is over the New York-Cleveland Route, where they started at 10 cents per mile; almost immediately raised to 20 cents per mile and some time ago raised to 30 cents per mile in an effort to keep the passengers away. Despite this excessive rate they seldom make a daylight trip without a passenger. They took this stand because the territory over these Allegheny Mountains is the most hazardous in the country; more disturbed air and the terrain is generally bad for forced landings. Our line expect to adhere closely to this rate. The charge, or rather the fare between Chicago and Twin Cities has been $40.00 for the 399 air miles, however, effective tomorrow (March 1st, 1929) the fare is reduced to $35.00 and the time is cut slightly. There are now several dozen passenger carrying lines in the United States; all of which have been established since March 1st, 1928. There are more than three hundred taxi companies operating, from whom one can rent a plane, with or without a pilot, to travel to any part of the country, however, this service is pretty expensive and, therefore, not so very popular.

Limitations

Now, lest we practical minded men be carried away by our high expectations for a definite commercial success for aviation on a very large scale; your speaker wants to leave one real consideration with you, i.e., Limitations may be imposed as surely by considerations of economic expediency as by the more rigid restrictions of natural laws, e.g., we could build freight or cargo ships that would carry freight across the ocean as fast as the fastest passenger steamer. Why don't we? The answer is very simple; they would not pay. A steamship moves about four tons për H.P. A locomotive moves about one ton per H.P., each being affected by the speed that it is required to be moved, of course, but a quarter of a century of experiments has convinced aviation engineers that 25 lbs. per H.P. is the absolute limit for an airplane. The plane must not only support itself but it must propel itself in addition. Byrd's plane weighed 22.5 lbs. per H.P., Lindbergh's 23.6 and Chamberlain's 24.5 and all were near the danger limit and all had trouble taking off. When Captain Rene Fonck started for France in September, 1926, he had slightly in excess of 25 lbs. and you may recall that he got off; apparently had sufficient buoyancy as long as he was heading into the wind but fell and crashed in flames before he was entirely off the field.

Now, gentlemen, please do not understand me erringly. There is a place for air transport and in certain exceptional circumstances probably a very considerable place, but never the whole transportation place because earth and water can sustain great weight while air cannot.

Railroads Now One Century Old

The Railroads are now one century old. Their future importance to the Country will be greater than ever in the past. Other and newer forms of transportation will be growing up side by side with them. Our Country will need the best that each can provide. The new era will be one of Co-operation and Co-ordination in order that the public may have the benefit of a strong and healthy transport system; the component parts of which will be, The Railroads, The Motor Cars, and the Air Ships. There will be room for all and all will be necessary for as far into the future as anyone now alive can predict.

PRESIDENT: Now, gentlemen, I think you have heard about everything in connection with the airplane that is possible to tell you today, but in view of the fact that we are going to have a very large airport in our own immediate vicinity here, it might be that someone here tonight would have a thought they would like to ask Mr. McMaster individually, with reference to its relation to the City of Pittsburgh, I am sure Mr. McMaster will answer any question you want to ask him in that respect. I don't know how your feelings are individually with respect to the airplane business,—I know my own. I might ask John Hughes, because he invited me to take a trip in an airplane.

JOHN E. HUGHES: Mr. President and other gentlemen, I want to congratulate Mr. McMaster on the very splendid address he gave us here tonight in connection with aviation and the railroads.

I happen to be a member of the Pittsburgh Chapter of the National Association of Aeronautics, and I am just wondering if we cannot get out of the splendid crowd here tonight more interest in this association in Pittsburgh.

Looking over one of the pamphlets from this association, President Coolidge said, "There is need to give the fullest encouragement to aviation and its interests, and the National Aeronautic Association is one of the valued instruments through which to accomplish this.' If a lot of our boys would familiarize themselves with what aviation is doing right around home here today, I feel certain that there would be more interest in aviation. Every American thrills with pride when he hears the tales of America's conquests in the air. Mr. McMaster has told you that we rejoice in our advancement of the airplane, we revel in our endurance record and excel in our speed around the world. The leadership, that prominence, that wonderful stimulus must not be allowed to wane. I would like to emphasize what Mr. McMaster has said by stimulating interest in aeronautics, particularly the Pittsburgh Chapter, and our membership here, if they will be good enough to come to me and talk about it.

PRESIDENT: I want to say this to you, this was not premeditated on the part of John Hughes and I. I did not know he was prepared to make this address. Now I will have to depend on someone else on their own accord; I won't risk that again.

DISCUSSION

Much discussion developed on the various instruments, devices and conditions surrounding the operation of aircraft. The details of the pitch and bank indicator and inclinometer were explained, i.e., that the device is a crossed transparent tube about eight inches long vertically, and six inches long horizontally; that when both stand at zero the plane is absolutely upon an even keel; that the indications on the vertical tube show whether the ship is climbing or nosing and the status of the horizontal tube indicates whether either wing is low or in a bank, so to speak.

The atmospheric conditions or "air pockets" were discussed and the speaker explained that it is his understanding that there is no place in the air where there is a void as might be conceived by the word pocket; that he understands that the atmospheric pressure is constant for the altitude taken, therefore, what is mentioned as air pockets is, in fact, air currents changing and diverging.

The motivation of the glider seemed to concern the membership. The speaker explained that the glider is motivated by taking advantage of the air currents; that this is the essence of piloting. He then went on to explain that a knowledge of air currens on the part of the Wright Brothers, through their familiarity with gliders, was probably responsible for their success in the air field, i.e., that they had mastered the currents and were, in fact, pilots before they applied power to their glider, as it were. He explained at this juncture that the intimate history of the exploits of the Wrights indicates that their sister, Katherine, who is now the wife of Henry J. Haskell, Editor of the Kansas City Star, Kansas City, Mo., where they now reside, was the inspirer of her brothers by supplying the force and understanding which they so much required.

MR. FRANK J. LANAHAN: It might be of interest to our distinguished speaker to ascertain how many in the audience tonight have been up in the air. I do not mean in the vernacular of the day, but how many here have been up in an aeroplane or a seaplane. Will all that have, please stand up? (About twenty arose).

My object, Mr. President, in asking this question was to really thank the speaker for the compliment that he paid the audience in presuming that we were all flyers. He had us all believe that we were all acquainted with aviation and could minutely follow every detail of his interesting talk. I cannot help but feel like the colored fellow who was asked to change a Twenty Dollar bill. He could not but was grateful for the compliment.

As I listened to the interesting narrative of Mr. McMaster there came to my mind a story of General John F. O'Ryan, who told of a colored cook down in Texas, identified during the war with an aviation outfit. The Colonel of the regiment discovered after six months' occupancy, the culinary artist had never been up in an aeroplane, so one day he told him that he himself would give him a ride. "No, Colonel, not this nigger," he replied. The officer assured him he was just as safe in the air as he was down on the ground, but the colored fellow shook his head and said, "That might be all right for you aviators, Colonel, but as for this nigger, terra firma, and the more 'firma' the less 'terra'."

It is hard to believe, as we listened to Mr. McMaster's interesting narrative, that this is February, 1929. The wonderful things that the speaker tells us about aviation and its practical use for transportation are amazing—the carrying of passengers from one end of the country to the other in safety and on a regular schedule. Why Jules Verne had nothing on this!

It seems pertinent to remark that we who are gathered here tonight, as the development of this new industry becomes more and more a matter of use, and in time the people accept it with more degree of matter of fact as we do the automobile and the railroad—will look back to the memory of this talk of Mr. McMaster and recall the prophecy of this learned young man. And isn't it wonderful we are living in such an age of marvelous inventions and resourceful men, who are doing such great things in aviation, radio, telephone and telegraph, submarine and chemistry?

I am sure we were all delighted to be here and listen to Mr. McMaster's presentation of such a live topic. All of us join in paying tribute to the speaker of the evening and Mr. President, with your permission, I move a rising vote of thanks to the speaker for his exceedingly interesting discourse.

The motion was carried by all arising.

MR. McMASTER: Gentlemen, I thank you. I am afraid you have given me a little too much credit for that, as those are only a few details that come along. When you think about those things any one of you would probably be able to dope out more than that.

PRESIDENT: I have one announcement to make before the meeting comes to a close. At eight o'clock P. M., on February 22nd, we were separated by death from one of our very dear friends, Mr. L. H. Turner. Mr. Turner was special representative and Vice President of the Pittsburgh & Lake Erie Railroad, was one of the charter members and organizers of this club in 1901, its second President in the years 1903 to 1905, inclusive, and at the time of his death was senior member of the Executive Committee. A suitable memorial to this effect will appear in the minutes of this meeting.

If there is no other business before the Chair I will ask for a motion to adjourn.

MR. LANAHAN: Before moving to adjourn—while I know it is unusual—but due to the circumstances that one of the charter members of the Club has just passed along the Great Trail, and that this organization practically owes its inception to him, I ask you, Mr. President, adjourning that in memory of Mr. L. H. Turner, that we all rise in respectful attention.

PRESIDENT: Let us close in that manner.

(The audience arose).

PRESIDENT: I thank you.

Upon motion meeting adjourned.

J. D. CONWAY, Secretary.

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H. G. SCHECK,
Died, February 16, 1929.

L. H. TURNER,
Died, February 22, 1929.

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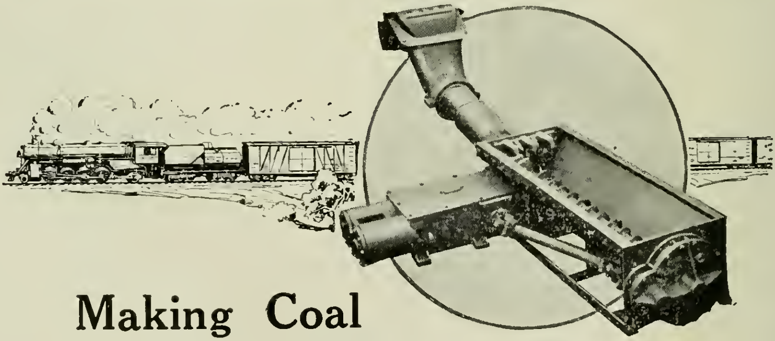

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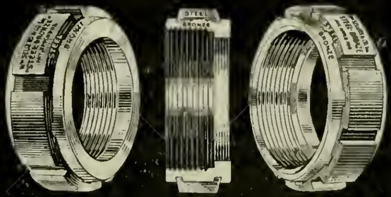

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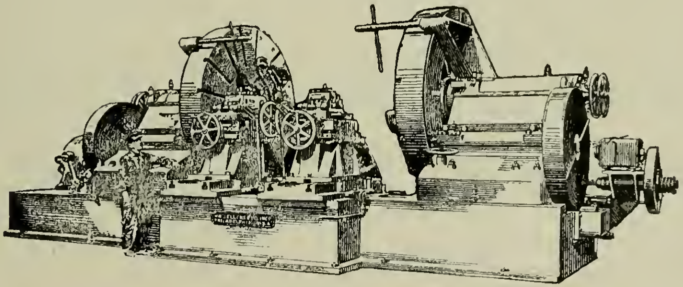

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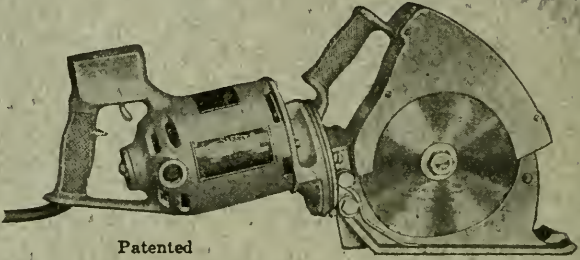

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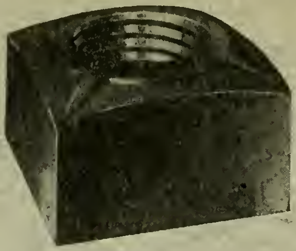

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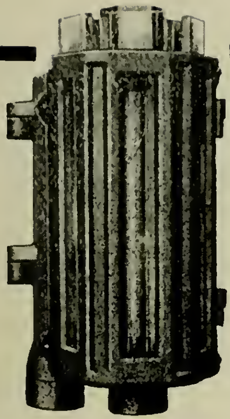

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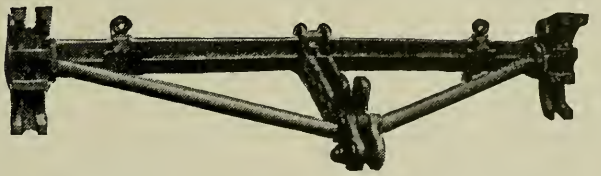

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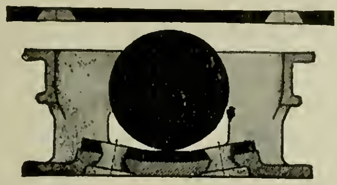

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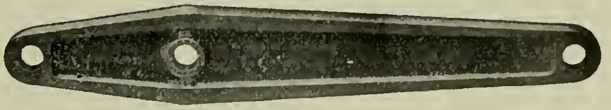

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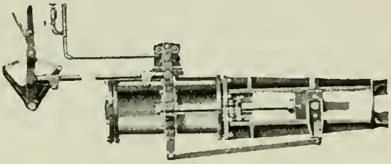

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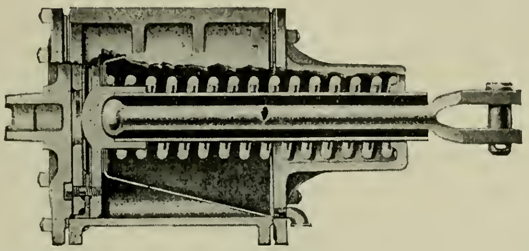

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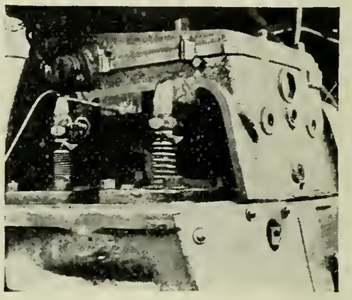

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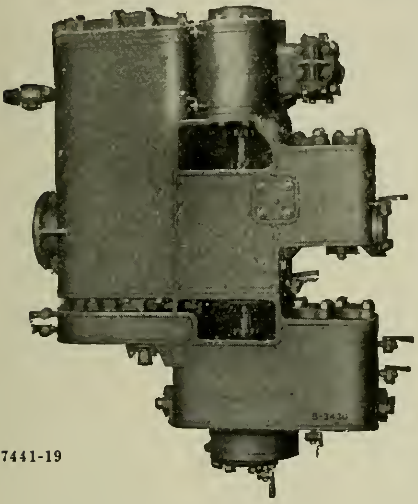

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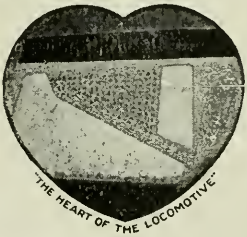

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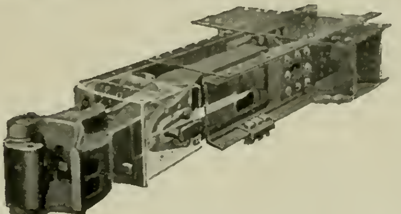

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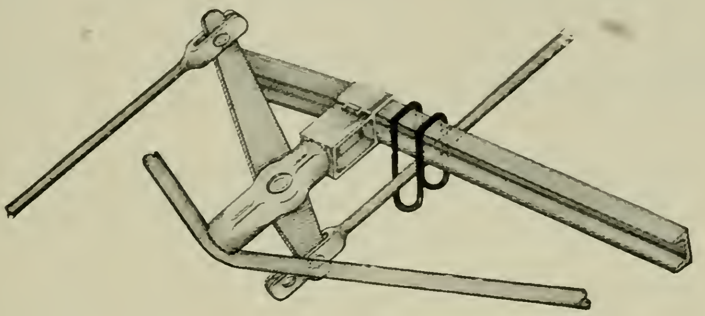

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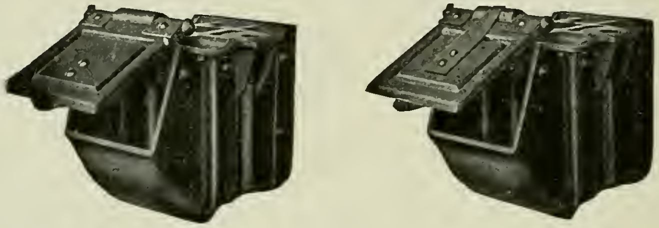

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OF

The Railway Club of Pittsburgh

Organized October 18, 1901

Published monthly, except June, July and August, by The Railway Club of Pittsburgh, J. D. Conway, Secretary, 515 Grandview Ave., Pittsburgh, Pa.
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Pittsburgh, Pa., Mar. 28, 1929.
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*L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
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GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
MARCH 28, 1929

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

MEMBERS

Allen, E. J.
Allen, Harvey
Altsman, W. H.
Barr, J.K.
Beam, E. J.
Berg, Karl
Berghane, A. L.
Bowen, James T.
Brinkhoff, W. H.
Burnes, J. E.
Campbell, C. A.
Campbell, J. E.
Campbell, J. T.
Cipro, Thomas
Conway, J. D.
Cotter, George L.
Coulter, A. F.
Crawford, D. F.
Cunningham, R. T.
Dambach, C. O.
Davis, Charles S.
Dempsey, P. W.
Descamp, J.
Duff, S. L.
Dunlap, Robert, Jr.
En Dean, J. T.
Endsley, Prof. Louis E.
Evans, E.
Fendner, W. J.
Fitzgerald, T.
Fletcher, A.
Flynn, E. E.
Gorman, Charles
Gorman, P. F.
Hamilton, William
Harper, G. C.
Holmes, E. H.
Hoover, J. W.
Hughes, J. E.
Hussong, A. C., Jr.
Ketchpel, Paul A.
Kroske, J. F.
Kummer, J. H.
Laurent, Joseph A.
Lawson, A. F.
Lehr, H. W.
Lobez, P. L.
Ludgate, B. A.
Lunden, C. J.
Lynn, Samuel
Mertz, G. H.
Miller, J. C.
Mills, C. C.
Mitchell, W. S.
McAbee, W. S.
McDonald, J. A.
McGinnis, Thomas P.
McKinley, Archie
McLaughlin, H. B.
McMillan, A. P.
McNelty, A. P.
McPherson, A. R.
Nagel, James
Ness, H. S.
O'Leary, J. J.
Orchard, Charles
Painter, Joseph
Paisley, F. R.
Pehrson, A. K.
Perry, W. E.
Provost, S. W.
Ralston, J. A.
Rauschart, E. A.
Reddick, W. E.
Redding, P. E.
Rogers, Robert
Rossell, R. T.
Rushneck, G. L.
Sample, W. E.
Sattley, E. C.
Semethy, J.
Semmer, M. R.

Seroky, Edward A.
Simons, Philip
Shannon, David E.
Sheridan, T. F.
Snyder, F. I.
Stamets, William K.
Sterling, C. C.
Stevens, R. R.
Stoffregen, Louis E.
Sutherland, Lloyd
Thompson, F. J.
Trautman, Harry J.
Vandivort, R. E.
Walther, G. C.
Warfel, J. A.
Woodward, Robert
Wright, O. L.

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Altimas, J. D.
Bougher, J. T.
Bradford, W. H.
Braithwaite, George L.
Carruthers, George R.
Clark, O. F.
Clinton, M. R.
Cummings, C. W.
Davern, F. C.
Davis, William B.
Depp, P. C.
Duffy, Ralph
Dunham, C. W.
Edwards, G. H.
Ensheimer, Louis
Eynon, R. J.
Ferguson, James H.
Frederick, D. C.
Gable, H. R.
Geer, William
Gormley, J. A. G.
Hawthorne, H. J.
Hortter, F. A.
Keller, S. S.
Kennan, E. T.
Kidd, Prof. Howard C.
Kiernan, J. P.
Latfield, A.
Lewis, S. B.
Malone, G. F.
Mann, J. R.
Meredith, L. H.
Miller, George P.
Murphy, J. E.
O'Meara, W. P.
Oschman, William
Packer, C. B.
Phelan, W.
Reeves, E. G.
Ross, W. Taylor
Schmitt, Raymond F.
Seabrook, Paul W.
Smith, Robert W.
Thayer, V. D.
Whitehead, I. J.
Woodroof, J. D.
Wright, C. B.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Adler, Abe C., Clerk, Union Railroad Co., 515 South Park Street, East Pittsburgh, Pa. Recommended by D. Cavanagh—W. S. McAbee.

Baker, J. B., Chief Engineer M. of W., Pennsylvania Railroad, Pennsylvania Station, Pittsburgh, Pa. Recommended by A. A. Read.

Davern, F. C., Sales Engineer, Nathan Manufacturing Company, 123 Carmel Road, Buffalo, N. Y. Recommended by J. D. Conway.

Dunlap, Robert J., Jr., Terminal Foreman, Montour Railroad Company, Willock, Pa. Recommended by E. A. Rauschart.

Gable, Harry R., Time Checker, Union Railroad, 661 Sixth Street, Pittsburgh, Pa. Recommended by A. Fletcher.

Kerr, Clark R., Assistant Car Foreman, Union Railroad Company, 1109 Wool Street, Duquesne, Pa. Recommended by J. J. Fisher—W. S. McAbee.

Kidd, Prof. Howard C., Professor of Commerce, University of Pittsburgh, Pittsburgh, Pa. Recommended by J. D. Conway.

Koehler, Paul A., Clerk, Union Railroad Company, 739 Glenn Street, Wilkinsburg, Pa. Recommended by D. Cavanagh —W. S. McAbee.

Zammikiel, John, Clerk, Union Railroad Co., 413 Boyd Street, Turtle Creek, Pa. Recommended by D. Cavanagh—W. S. McAbee.

PRESIDENT: These applications will be referred to the Executive Committee, in accordance with our By-Laws, and upon approval by them the gentlemen will become members without further action.

If there is no further business, we come to the paper of the evening. The speaker is Professor Howard C. Kidd, of the University of Pittsburgh, who is the author of a number of books on railroad subjects and has made several investigations of foreign railroad systems for the United States Government. He will now address you upon the subject of A Comparison of Policies of Consolidation of Railways in Great Britain and America.

CONSOLIDATION OF RAILROADS IN ENGLAND AND AMERICA

By HOWARD C. KIDD, Ph.D.,
Professor of Commerce, University of Pittsburgh, Pittsburgh, Pa.

I appreciate the opportunity of holding a conversation with the men of the Railway Club of Pittsburgh on an interesting study I made last year in England. This study was concerned primarily with the consolidation of the one hundred and twenty British lines into four. However, before touching on the consolidation problem I wish to speak of the Railways Act of 1921 which is now the basic railway legislation of Great Britain.

A few hours after Great Britain declared war on Germany, in August, 1914, the railways of Great Britain were drafted into the military service of the crown. Seven years later, in August, 1921, these railways were returned by the Government to their owners. For seven years they were primarily machines of war; at last they became once more the instruments of commerce.

In returning these railways the government was faced with two problems: the settlement of the financial claims arising out of war control and the definition of the future policy of the State towards the railroads. Both of these problems were dealt with in the Railways Act of 1921.

Regarding the financial problem the railways asked $750,000,000 for compensation. The Government offered them $300,000,000. This offer was accepted by the railways and the financial issue was closed.

The definition of the future policy of the State towards the railways was a much more difficult matter to settle than the financial claims. Three distinct points of view emerged in the discussion.

The first point of view was that maintained by the "die hard" conservatives who wished to have no interference whatever by the Government. Opposed to this group were the socialists and the members of the Labor Party who demanded the State ownership of all the railways of Great Britain. Somewhere between these extreme poles of thought was the policy advocated by Sir Eric Geddes representing the Government. Sir Eric proposed that the railways of Great Britain should be privately owned but that in the future they should be rigidly controlled by the State. The law which embodied these ideas of Sir Eric is known as the Railways Act, 1921.

The Railways Act, 1921, proposed two important changes in the administration of the British railways: amalgamation of railways and the control of rates under much the same conditions as obtain in the United States where the Interstate Commerce Commission is the final arbiter. It is with the consolidation program sponsored by the Railway Act, 1921, that I shall confine the rest of my remarks.

A few weeks ago "The New Republic" made the interesting observation that railroad consolidation will "probably be one of the most important economic events during the next administration." Whether this prediction be taken at its face value or not it is impossible to ignore the significance of the problem of railroad grouping in the United States.

In America the consolidation of railroads is still in the debate stage; in Great Britain it has come to fruition. Great Britain can, therefore, be regarded as a laboratory in which an experiment vital to the economic well-being of both countries is being made.

Five years ago, one hundred and twenty railroad corporations in Great Britain were organized into four groups. The mere statement of this fact suggests an amazing chapter in railroad history. How was such a vast undertaking accomplished? What are the results?

Dictatorship

The key to the method of British railway consolidation is summed up in one word: dictatorship. The British Government told the railroads exactly what to do and how to do it. The railroads merely obeyed orders. The result has been one of the greatest revolutions in corporate management in modern times. This momentous change in British railroad organization can be examined briefly under the following headings: the compulsory feature, the theory of complete mergers, the time element, the machinery of grouping, the financial arrangements, and the results of amalgamation.

Compulsory Amalgamation In Great Britain

As has been stated, British railway consolidations were compulsory. Parliament passed an act in 1921 which laid down the principle that "railways shall be formed into groups." There was no ambiguity in this statement. Each railroad was assigned to one of the four groups in the Act itself. Only on matters of detail did the British railways challenge the decision of Parliament. In commenting on this phase of grouping the eminent British economist, Sir William Acworth, said that "no higher testimony to the traditional English virtues of moderation and willingness to compromise was ever given."

Voluntary Grouping In The United States

In contrast with the British policy of compulsion stands the American theory of voluntary consolidation. In the United

States, since 1920, consolidation is permissible, not compulsory. But the permission to consolidate is hedged about by so many restrictions that no important merger has been formed during these eight years. For example, three consolidations which have been thwarted include the Van Swerengen merger based on the Nickel Plate Railroad, the Loree grouping of the lines in the Southwest, and the integration of the Northern Pacific, the Great Northern, and the Burlington systems. In his annual message to Congress a year ago President Coolidge said that if consolidation is to be achieved in America, "legislation of a new type must be passed, legislation with teeth in it." In reality, if voluntary consolidation is to be achieved, a few teeth might well be extracted from our present law. If compulsory consolidation of American Railroads is what we want, an entirely new piece of legislation must be drafted.

Complete Absorption Of Subsidiary Companies

The British theory of railroad mergers is the complete absorption of subsidiary companies. There is no provision for holding companies, or the mere control of one railroad by another. Thus only one of the old British railways, the Great Western, retained its identity. Regarding this one survival, Arnold Bennett gave vent to the following burst of enthusiasm, which, if taken literally, would be somewhat embarrassing to the Great Western itself: "In the amalgamation of great railway systems some years ago the Great Western alone kept its identity. It is still the Great Western; no muddling outsiders have come to introduce damnable improvements, economies, and modernizations. It is conspicuously more the Great Western than ever."

American Theory Of Mergers

In America, mergers have been accomplished either through holding companies, stock control, or leases. For example, the Pittsburgh and Lake Erie Railroad is part of the New York Central System; yet it operates as a separate corporation and in every respect retains its identity. Our present policy is so defined in the transportation Act of 1920 that complete mergers are illegal until the final plan of railroad grouping for the country as a whole has secured the approval of the Interstate Commerce Commission. When that approval is finally secured, we shall undoubtedly follow the British precedent of complete absorption.

Amalgamation In Less Than Two Years

The speed with which the one hundred and twenty British railways were consolidated is remarkable. The law proposing consolidation was passed in August, 1921. At that time "The Railway Gazette" declared that "it will be impossible for such enormous and delicate operations to be carried out within the compass of one or two years." The "enormous and delicate operations" were performed, however, with such dispatch and dexterity that as early as November, 1922, "The Economist" was able to announce: "The details of the principal amalgamation proposals are completed." Regarding this achievement, "The Times," on December 29, 1922, observed that "the prophets are confounded." Sir Henry Thornton aptly said: "We were required to produce, almost over night, a thing which elsewhere had taken thirty or forty years."

The Machinery Of Grouping

The machinery by which the consolidation of the British railways was accomplished was the Amalgamation Tribunal. This Tribunal was constituted as a court of record; it was composed of three men vested with power which, for scope, has few parallels in modern economic history.

Contrary to usual procedure, the names of the members of the Tribunal were included in the Railways Act of 1921. In naming these men in the act, the government virtually said to the public: "Whatever you may think of this complicated legislation, these men—one a banker, one an accountant, one a barrister—can be depended on to deal fairly with all interests concerned."

It is typical of British administration that the Tribunal set up no code of rules. It regarded its work more as an art than an exact science. As one critic observed, the Tribunal in reaching a decision defended its judgment on the theory that "whatever the legal merits of the question, it was expedient."

Absolute Power Of The Tribunal

The Tribunal had the right to approve any amalgamation or absorption scheme; its decisions had the binding force of an Act of Parliament. Since no Act of Parliament can be unconstitutional, under the British system of jurisprudence, the power of the Tribunal was practically absolute. It is true that, in theory, on questions of law, appeals could be taken to the Courts or even to the House of Lords; but in practice only a few cases were taken on appeal to the Courts. No appeals were made to the House of Lords.

The work of the Amalgamation Tribunal is an excellent example of the growing tendency of democratic governments to function through bodies having almost unlimited administrative discretion. Parliament laid down the broad principles of railroad amalgamation, but the Amalgamation Tribunal was given a free hand in working out the details and in bringing consolidation to completion. It would be difficult to find a better example of the enlightened use of delegated authority than the course of action pursued by this British Amalgamation Tribunal.

Financial Arrangements

The financial arrangements by which the British amalgamations were effected are especially interesting to American students of consolidation, because it is these arrangements which have proved to be our most serious stumbling block.

What is a railroad worth? In America, we have tried to think in terms of physical valuation. Since 1912, we have spent $150,000,000 in an effort to make an accurate inventory of our railroad properties, but the survey is still far from complete.

In the case of temporary mergers, we have relied on the control of shares of stock by the absorbing railroad; but this method immediately throws the consolidation schemes into the arena of speculation. It results in endless struggles between majority and minority stockholders; in unwarranted manipulation on the stock exchange; and in personal aggrandizement on the part of insiders. Only a short time ago Mr. L. F. Loree, chairman of the Board of the Kansas City Southern Railroad, was accused of making a profit of $144,000 in the mere attempt to consolidate the Southwestern railroads.

Value Based On Earnings

The British Government cut the gordian knot of consolidation finance by adopting the simple principle that **a railroad is worth what it earns.** It therefore, looked at the earning power of the railroads for the highly prosperous year, 1913, and decided that to be the measure of value. Although this was not the only consideration, earning power was undoubtedly the most important one in effecting the exchange of securities. If Britain had adopted any other method than the capitalization of earnings as the basis of value, it is hardly likely that consolidation would have been achieved before the Greek Kalends.

Results Of Consolidation

What have been the results of the consolidation of British Railroads? To answer this question would require an extended analysis. Briefly, however, it may be said that consolidation has resulted in standardization of equipment, in centralization of administration, and in the introduction of large scale methods of production in the railroad shops. An illustration of each of these phases will be presented to indicate the tendencies which have been set in motion.

Standardization

On one railroad, the Southern, there were one hundred and thirty-five types of locomotives at the time of amalgamation. These have now been reduced to nine; and in these nine there are only four types of boilers and four sets of motion.

Before amalgamation there was no uniform system of continuous brakes. The result was that all through trains had to be equipped with two types of brakes: the Vacuum and the Westinghouse. The Vacuum brake is now adopted as the standard.

On the electrified lines two systems of transmission were in use before amalgamation: the third rail and the overhead trolley. The result was that trains were not interchangeable between lines using the two methods. The third rail system has now been adopted as better suited to British conditions.

Centralization Of Administration

The centralization of administration is typified by the fact that the number of directors has been reduced from thirteen hundred to one hundred. Although the direct savings in fees are negligible, it is obvious that with more concentrated authority the administrative policy of British railroads should be more coherent and efficient. As one member of Parliament put the case: "The Government had to deal with concerns managed by one hundred and twenty boards of directors, many of whom directed no one but themselves; who had neither rolling stock nor staff; but who successfully used their influence against every progressive suggestion that was made by the large companies." This condition is no longer possible under the reorganization which has taken place.

Efficiency In Shops

An illustration of efficiency in shop organization and practice which has resulted from amalgamation is the experience of the London, Midland and Scottish Railway at its Derby plant. Here manufacturing costs in building locomotives have been lowered thirty per cent. since 1925, and the number of locomotives awaiting repairs has been reduced five per cent. This latter item represents the release of five hundred locomotives which would cost, at present prices, $12,000,000. Many other cases might be cited to show how the concentration of shops has resulted in lower unit costs.

* * * * *

In the crucible of this post war decade, the British railways have been remade. The pattern of their design is larger; the concentration of their power is greater. It is certain that, even if it were possible, few British railway men would care to return to the old regime.

PRESIDENT: You have heard a very interesting address. Professor Kidd has expressed a willingness to answer any questions you may wish to ask, and that opportunity is now afforded you.

If no one is going to volunteer discussion I shall have to draft you. I am going to ask Mr. Fitzgerald to start the discussion.

MR. T. J. FITZGERALD: I do not see how a street railway man gets into a picture of the English steam railroads. The question that comes to my mind is: what is the rate base?

PROFESSOR KIDD: The law says that the Rates Tribunal shall establish such rates as will bring in the standard revenue. The 1920 Act in this country said practically the same thing. In neither case has the standard revenue been achieved. The old law of competition seems to work pretty well. Of course, with the enormous development of motor bus competition in a country where the average haul is only fifty miles, charging what the traffic will bear—which is the only theory of rates that I understand—has cut down their ability to charge high rates.

An interesting thing about the British situation is that even if they had a complete monopoly and had no motor bus competition, they are still very subject to water competition. They have a complete system of canals and sixty per cent of the British population live within 15 miles of water transportation. So it is quite impossible for the railways to get away with too much murder, even if they had it in their hearts.

MR. FITZGERALD: Is there any result from a downward adjustment of rates, or is the transition period affecting the situation so that no conclusion could be drawn from a downward revision?

PROFESSOR KIDD: I think the downward revision of rates has been very disappointing. To quote Sir Josiah Stamp, who I believe is the most prominent English railroad man, the head of the L. M. & S., the representative of Great Britain on the Reparations Board, a director of the Bank of England, and the man who is regarded in England as the spokesman for the railways: "If we had not reduced rates we would not have had any traffic at all." But the reduction of rates has not solved the transportation difficulties of the railways. And now the railways have secured from Parliament the right to run their own busses even in competition with their own rail lines. They hope in this way to get into the bus business and recoup the losses they have incurred by the reduction in rates.

MR. FITZGERALD: Does their operation of busses preclude the operation of independent busses in competition?

PROFESSOR KIDD: No. Before July of this year the railways could only operate a bus that was supplementary. Now they can operate busses that are in competition with themselves. But the law does not preclude the right of any one else to go into the same business. And under the law a competitor if he goes into the business he has the right to use the facilities of the railway in the way of stations, etc.

PRESIDENT: Professor Endsley, have you anything to offer on the subject?

PROF. LOUIS E. ENDSLEY: I wonder how long they have to keep these men on who are unnecessary, or is that a job that is only over when he dies?

PROFESSOR KIDD: I think that is the heart of the whole question. In one railway office that I studied I found an interesting situation. This office employed about 110 people. I estimated that by the introduction of improved accounting machinery, adding machines, etc., they could cut down the office force something like sixty per cent. They had old men who put their pens behind their ears as they did in the days of Dickens, scratching away in the old methods of the year one. I said to the manager, "Why is this? Why don't you introduce at least one new machine to show that you live in 1928." He said, "If we introduce these machines and lay these men off we will have to compensate them, and we will have the cost of the machines as well as the cost of compensation. The law says a man is entitled to the same position he had before the consolidation, or he is entitled to compensation." The manager said most of these men will either die or be pensioned by the year 1932 and then they will introduce machines.

I think that is an awfully good illustration of the strength and solidarity of British labor. Geddes' bill had provided for representatives of labor on the Board of Directors. That was a good bargaining point. Labor said, "If we cannot get that, give us the principle, that no one should be discharged on account of the consolidation." They got what they wanted.

MR. FITZGERALD: Have investors received any returns since the amalgamation?

PROFESSOR KIDD: Yes. Their return does not look like very much to us, though. The English scale is a little different. In the very best year, 1913, the return on British investment was only four per cent and I think the return at the moment is something less than that. At the present price of money it does not look like very much.

PROFESSOR ENDSLEY: Looking over the English situation, if we should consolidate the way they did in England, how many sections would we have in this country?

PROFESSOR KIDD: When Mr. Ripley was appointed by the Interstate Commerce Commission to look into that question he suggested nineteen. I imagine if you were to get the presidents of the 185 Class I railroads together in this room you would come out with 185 systems.

MR. C. ORCHARD: You mentioned motor busses. I suppose that is with respect to passenger traffic. Are motor trucks used to a very great extent in the transportation of freight, and whether local transportation or in long distance movements?

PROFESSOR KIDD: I should have included in my statement motor busses and motor trucks. There is very keen competition. The railways have lost much of their traffic, within a radius of 100 miles. That short haul traffic was a bus earning factor for the railways and that has been entirely wiped out. And since their mileage is so short, even on heavy traffic they have lost pretty much. The average haul of steel from factory to port in England is 30 miles; in this country it averages about 500 miles.

MR. FITZGERALD: Have the managements any idea that they can overcome this inefficient labor situation?

PROFESSOR KIDD: I think death is the only thing that can come to their assistance.

MR. FITZGERALD: The death of the properties? Or—

PROFESSOR KIDD: The death of the men.

MR. FITZGERALD: Which do they think will come first?

PROFESSOR KIDD: They think it is a very close race. They can get some investors to bet one way and some the other.

MEMBER: What is their general pension scheme?

PROFESSOR KIDD: It is a very detailed scheme. It would take too long to elaborate it. It is true, however, that the railways are very anxious to bring down the pension age, because they see how they are tied up.

MR. FITZGERALD: Do you mean they get full wage as a pension?

PROFESSOR KIDD: They get pretty near full wage. There are some deductions. I have forgotten the details of that. I made a study of one class of works and I think it was within ten per cent of their full wage.

MEMBER: Is there any contribution by the employee toward that pension fund?

PROFESSOR KIDD: There is no contribution. This is a very good illustration of the power of labor. I had no idea of the solidarity and the absolute power of the British labor bodies. I came away with the belief that it is just a question of time until we have a return of the labor government in England. And it shows itself all through its legislation.

MEMBER: I would like to ask if it is not true that they do not have over there anything like the difficulty that we do over the return of equipment to their respective systems.

PROFESSOR KIDD: They have worked out over there for all wagons over 12 tons what they call a pooling system and the actual ownership of the car does not make any difference. Suppose the L. M. & S. had 1,000 cars and the L. & N. E. had 1,200. The actual ownership of these cars at any one time makes no difference. That should cut the empty mileage considerably, but in fact it has not been cut very much. I was expecting to get great proof statistically of the reduction of empty mileage. I did not get it. The railway men say that is because of the private ownership of those wagons, fifty per cent being privately owned. In private ownership they have to return to the owning corporation the empty car.

I must say I was very much impressed with the railway clearing house, though I did not make a detailed study of it. I wish I had had time to make that study, because it would be interesting to see if we could bring over to this country something that would correspond to a national clearing of freight cars, resembling the Federal Reserve System of national clearing of bank balances. I must say I did not understand very much about it but it looked good.

MEMBER: Why don't the railroads buy their own equipment in England?

PROFESSOR KIDD: There seems to be a long history back of that. The private ownership of cars gave to those owners such great advantages over the mines, particularly—they were mostly mine cars—over the mines that did not own their own equipment. It seems to be a very ticklish spot if the railway men have sensitive spots. It was very difficult to get a free discussion of the private ownership car situation. I would get opinions and then I would be told not to quote them. In 1919 the legislation gave to the Minister of Transportation the right to acquire private cars, but no government in England has political strength enough to propose the carrying out of that legislation. Sir Eric Geddes said if he had done away with private cars it would introduce economies that would amount to something like $10,000,000 a year. But in all my investigation I found no debate on the subject in Parliament, I found no literature; and yet every railway man will tell you that is what is holding up the most perfect working out of the amalgamation economies. These private cars are not manufactured in the railway shops and that has prevented to some extent large scale production.

MR. ORCHARD: Have the railroads a uniform rate, that is a rate between given points which applies to the railroad owned cars the same as to privately owned cars?

PROFESSOR KIDD: The same rate.

MR. ORCHARD: What is the basis of compensation to the owners of private cars?

PROFESSOR KIDD: It is on a mileage basis.

MR. SAMUEL LYNN: I would like to ask about cars privately owned as compared with railroad owned cars, are these cars interchanged on the various systems similarly to freight cars that are privately owned in this country today?

PROFESSOR KIDD: Fifty per cent of the total railway car supply in England is privately owned and in matters of interchange there is complete interchange for loaded cars or empty cars getting them to or from the point of destination. But the private cars go back to the home property empty. That is the worst feature of the private car system.

M. J. E. HUGHES: I would like to ask if there were any economies realized at the time of the consolidation in handling through billing from point to point, or was there through billing established at the time of the consolidation which would reduce the expense?

PROFESSOR KIDD: Through billing was introduced by the government in 1914, and that was continued by the railroads when they were handed back by the government. I do not know what the situation was before 1914. One thing that impressed me very much was the matter of government control. The government did not disturb the railroads as they did in this country. Practically all railroad men in this country are agreed that their internal organization was much upset. The British government retained the management intact and disturbed them only slightly.

MR. FITZGERALD: What is the status of electrification?

PROFESSOR KIDD: Electrification is rather expensive. Within a radius of 30 miles of London the Southern Railway, south of London, has considerable electrification, and the railways think that the only way they can retain their position in competition with bus interurban traffic is by the adoption of electrification. But electricity is so expensive in comparison with the rates in this country that I think it will be very slow. Of course labor says the railways must solve the coal problem by the generation of electricity at the mines, but the government answers that this would make the labor problem in the coal districts very much worse.

MR. LYNN: Never having been abroad I will confess my ignorance. But with the large private ownership of cars how do they handle the maintenance of the privately owned cars? Our experience in this country is that cars will need minor repairs. Do the railroads repair the cars and bill the private owner or how do they handle that?

PROFESSOR KIDD: In minor cases the railways will make the repairs and render the bill. But the owning property will have its own repair shops. They have not been in the habit of consolidating with the railroads in maintaining repair shops.

MR. LYNN: Is there very much conflict between the handling companies and the owners of the equipment as to who shall be responsible?

PROFESSOR KIDD: No. There are a few altercations.

MR. HUGHES: Did consolidation speed up traffic to any extent?

PROFESSOR KIDD: I could argue that question both ways. I could get a lot of evidence on both sides. If you take 1913 figures and compare them with 1924, 1925 and 1926, I do not think you can show very much. But in 1913 the railroads say they had larger tonnage, much more complete utilization of plant, and all our statistics make us look better in 1913. There is that factor of the general position of British business that makes it very difficult for a person to say definitely one thing or the other. That is a very unsatisfactory answer, but it has to be because my information is unsatisfactory.

PRESIDENT: Is there anything further you would like to say, Professor Kidd, before we close the discussion?

PROFESSOR KIDD: I have said more than I know now.

MR. LYNN: Professor Kidd has given us a very instructive talk. It has been unusually interesting. I have read quite a lot about European railroads and equipment, but most of this talk has been a revelation to us. Professor Kidd spoke of standardization and I was just wondering how he got into standardization of American railroads. Our equipment is changing so rapidly, requiring larger castings and the handling of a very large stock that I rather question whether we really have any standardization of equipment.

However, I am sure the talk has been beneficial, as well as interesting, to all of us, and I offer a motion that Professor Kidd be extended a rising vote of thanks in expression of our appreciation.

The motion was duly seconded and prevailed by ananimous vote.

SECRETARY: Announcement was made at the last meeting of the death of Mr. L. H. Turner, our senior Past President and Chairman of our Executive Committee, and one of the original organizers of the Club. The organizers of this Club were Mr. D. F. Crawford, who is with us tonight, Mr. Turner, Mr. J. D. McElwain and Mr. Joseph H. McConnell. These were the four men who got together and conceived the idea of organizing this Club in October, 1901, and it has been in existence continuously since that time.

It may be a little out of order to bring up the matter of a Chairman for the Executive Committee, as that might be considered a matter for the decision of the Executive Committee itself. But we have with us tonight a representative number of the membership of that Committee and it might be well that a Chairman be selected tonight. It has been the practice to take the oldest past president of the Club and if that precedent were followed Mr. Frank J. Lanahan would be the ranking past president.

MR. LYNN: As a member of that Committee I believe it should be as the Secretary has stated, that the oldest past president should be the Chairman of that Committee, and I therefore nominate Mr. Lanahan to fill the place of Chairman made vacant by the death of Mr. Turner.

The nomination was seconded by Mr. D. F. Crawford, another member of the Committee, and, there being no further nominations, Mr. Lanahan was elected by acclamation.

There being no further business.

On Motion Adjourned.

J. D. CONWAY, Secretary.

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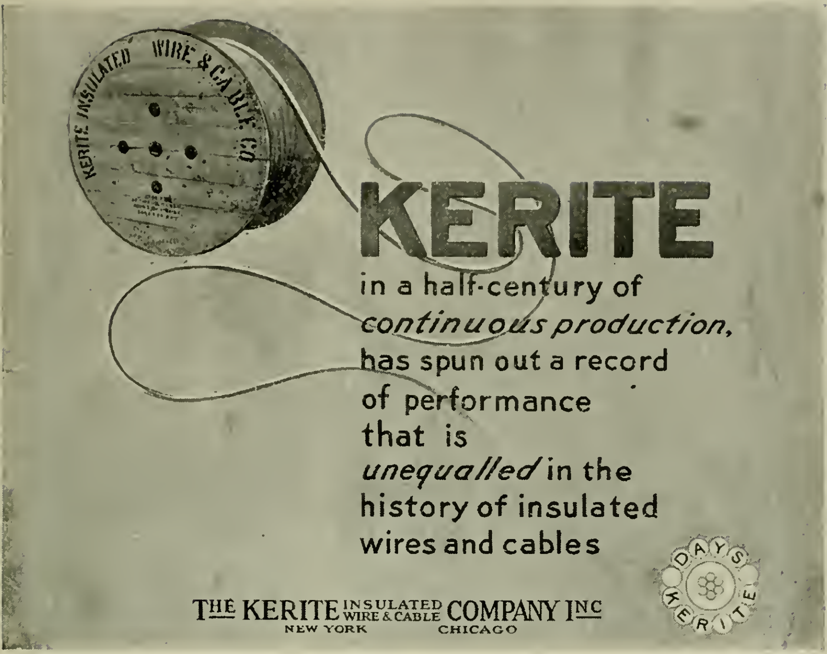
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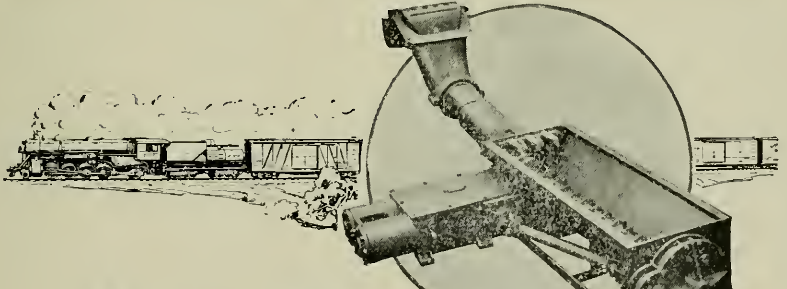

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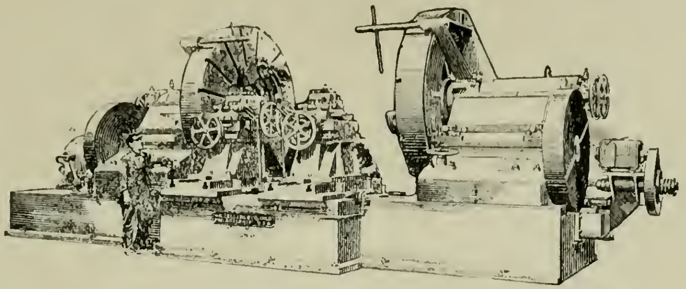

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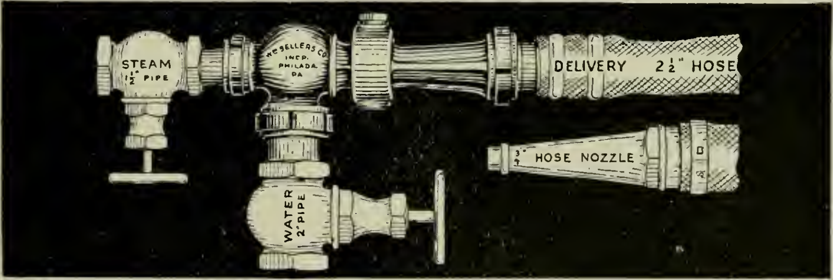

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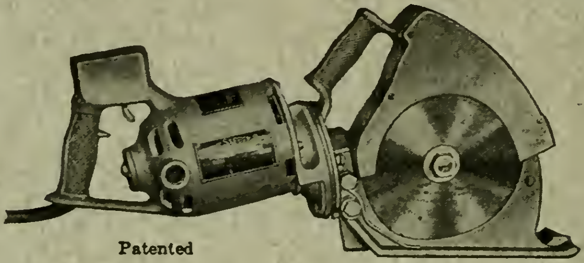

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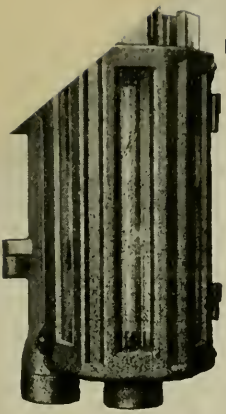

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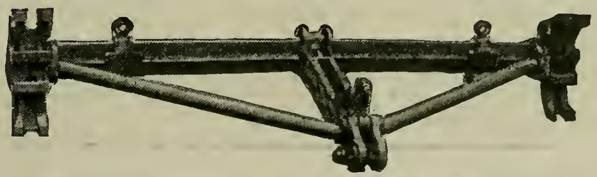

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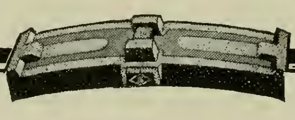

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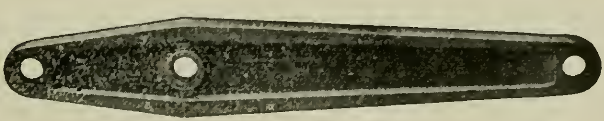

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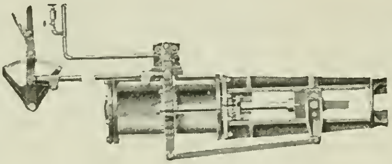

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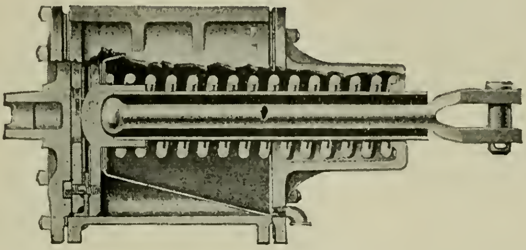

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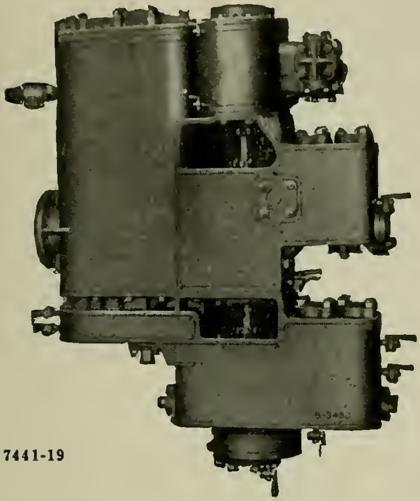

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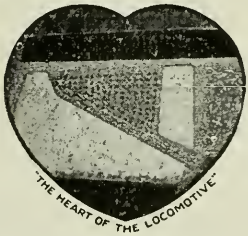

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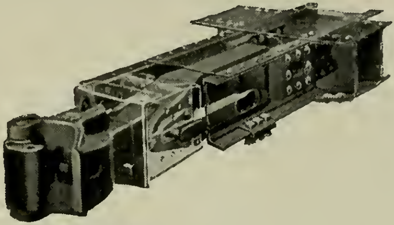

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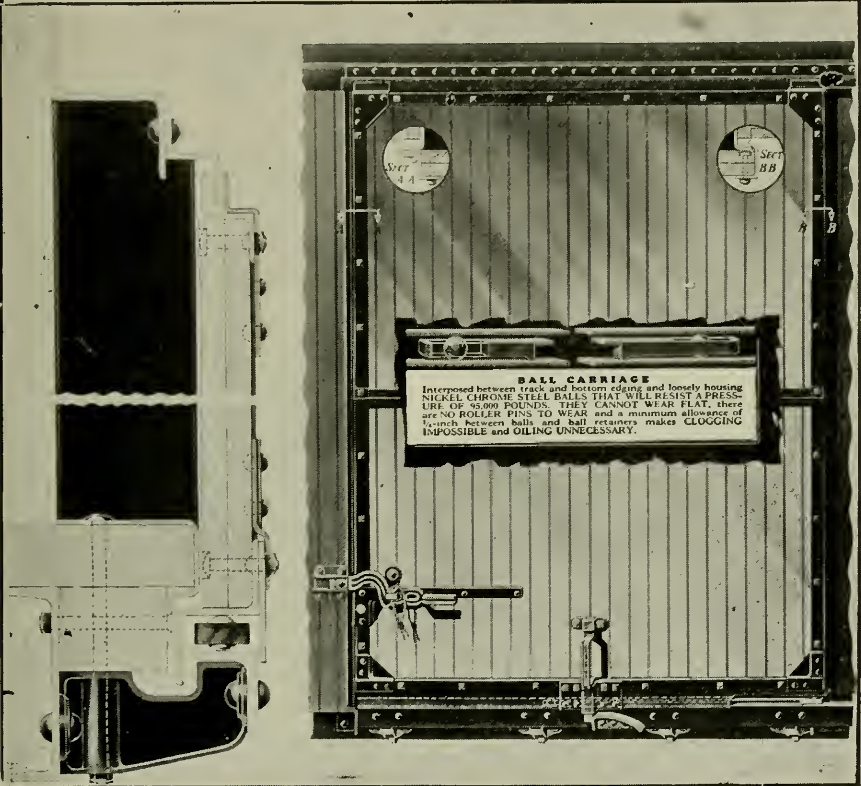

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Organized October 18, 1901

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No. 6.
Pittsburgh, Pa., April 25, 1929.
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F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

APRIL 25, 1929

The meeting was called to order at the Fort Pitt Hotel at 8:00 o'clock P. M., with President W. S. McAbee in the chair.

The following gentlemen registered:

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Beam, E. J.
Beck, C. H.
Berg, Karl
Berghane, A. L.
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Cunningham, R. I.
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Dempsey, P. W.
Dixon, T. L.
Down, S. G.
Durkin, James E.
Emery, E.
Endsley, Prof. Louis E.
Farrell, G. R.
Fendner, W. J.
Fischer, G. E.
Fisher, J. J.
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Freshwater F. H.
Gardner, K. C.
Gilg, Henry F.
Gorman, Charles
Gorman, P. F
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Johnson, A. B.
Karns, C. A.
Kaup, H. E.
Kearney, J. W.
Kelly, H. S.
Kiefer, Fred
Kier, Clark R.
King, T. C.
Kummer, Joseph H.
Lanahan, Frank J.
Lanahan, J. S.
Larsen, Jacob C.
Laurent, Joseph A.
Lehr, Harry W.
Linsenbigler, Allen J.
Lobez, P. L.
Long, R. M.
Ludgate, B. A.
Lunden, C. J.
Lynn, Samuel
Matchneer, W. W.
Millar, C. W.
Moir, W. B.
Molyneaux, Dawes S.
Muir, R. Y.
Myers, Arnold
McAbee, W. S.
McGinnis, Thomas P.
McGowan, C. H.
McHugh, C. A.
McIntyre, R. C.
McNamee, W.
McNelty, A. P.
Paisley, F. R.
Palmer, E. A.
Passmore, H E.

Rabold, W. E.
Ralston, J. A.
Redding, P. E.
Renshaw, W. B.
Reynolds, D. E.
Robinson, R. L.
Rogers, Robert
Roth, Philip J.
Rushneck, G. L.
Sample, W. E.
Searles, E. J.
Seiss, W. C.
Semethy, J.
Seroky, Edward A.
Severn, A. B.
Sheridan, T. F.
Smith, J. Frank
Snyder, F. I.
Stamm, Bruce B.
Stevens, L. V.
Stevens, R. R.
Stucki, A.
Suckfield, G. A.
Sutherland, Lloyd
Trance, F.
Trautman, Harry J.
Verret, Roy H.
Waterman, E. H.
Wetzel, James S.
Wheatley, William
Wible, T. E.
Wikkander, O. R.
Wright, Edward W.
Wright, John B.
Wright, O. L.
Wyke, J. W.

VISITORS

Anderson, J. P.
Arnoldson, D.
Brier, Isador
Black, G. A.
Carter, William
Caylor, J. H.
Cobb, Candler
Coombe, A. B.
Darrall, William G.
DeVilbiss, E. B.
Dietrich, W. S.
Duryea, O. C.
Ferguson, J. H.
Gollmer, H. C.
Halleran, H. J.
Hammond, H. D.
Hausson, S.
Henry, W. C. A.
Hewitt, Ellis E.
Hood, C. E.
Hopkins, G. H.
Johansson, O. H.
Johnson, A. H.
Jorgensen, G. K.
Koch, F. A. C.
Lewis, Goodrich Q.
Lewis, S. B.
Macpherson, Stuart
Manny, C. A.
Mateer, W. H.
Meyer, W. J.
Morrow, A. L.
Mullen, Thomas
McCafferty, Frank L.
McCann, J. P.
Norton, E. B.
Oyer, T.
Peck, W. F.
Rehlin, F. G.
Rehlin, W. C.
Rieger, N. H.
Schrontz, S. B.
Shemetz, T.
Schmid, William L.
Schmidt, E. H.
Schmitt, Raymond F.
Simonson, S.
Smith, Sion B.
Spence, H. L.
Stevenson, R. R.
Stewart, James
Steubing, A. F.
Sullivan, J. C.
Tallat, A. T.
Touceda, Prof. Enrique
Utzler, E. S.
Vair, George F.
Vold, L. H.

Von Krogh, F. F.
Waite, J. H.
Wille, A. H.
Woernly, H. F.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Carter, William, Purchasing Agent, Rees Manufacturing Corporation, 7501 Thomas Boulevard, Pittsburgh, Pa. Recommended by J. A. Ralston.

Cobb, Candler, Vice President, O. C. Duryea Corporation, 230 Park Avenue, New York, N. Y. Recommended by Samuel Lynn.

Coombe, A. B., Assistant Superintendent, Pressed Steel Car Company, 1515 Quail Avenue, Bellevue, Pa. Recommended by R. M. Long.

Duryea, O. C., President, O. C. Duryea Corporation, 230 Park Avenue, New York, N. Y. Recommended by Samuel Lynn.

Hammond, Harry D., Vice President, American Steel Foundries, 410 North Michigan Avenue, Chicago, Ill. Recommended by Frank J. Lanahan.

Lewis, Goodrich Q., Mechanical Engineer, W. H. Miner, Inc., 667 Rookery Building, Chicago, Ill. Recommended by J. A. Ralston.

Mateer, W. H., Director of Purchases, Standard Steel Car Company, Butler, Pa. Recommended by Frank J. Lanahan.

Schmitt, Raymond F., Clerk, Monongahela Connecting Railroad, 1714 Hatteras Street, N. S., Pittsburgh, Pa. Recommended by H. C. Pringle.

Stuebing, A. F., Chief Engineer, The Bradford Corporation, 25 West 43rd Street, New York, N. Y. Recommended by Frank J. Lanahan.

Touceda, Professor Enrique, Consulting Engineer, 943 Albany, N. Y. Recommended by Frank J. Lanahan.

Watt, Herbert J., Manager of Sales, Railway Materials, Jones & Laughlin Steel Corporation, Third and Ross Streets, Pittsburgh, Pa. Recommended by J. D. Conway.

PRESIDENT: These applications will be referred to the Executive Committee, in accordance with our By-Laws, and upon approval by them the gentlemen will become members without further action.

If there is no further business, we come to the paper of the evening, to be presented by Mr. O. C. Duryea, on the subject, "A New Type of Car Construction." In conversation with Mr. Duryea I am led to believe that it is more or less of a revolution in type, something that is foreign to the majority of us, and we will now give Mr. Duryea an opportunity to tell us about it:

The Duryea Underframe For Railroad Cars

By O. C. DURYEA, President
O. C. Duryea Corporation, 230 Park Avenue, New York City

Mr. President and Gentlemen:

Efficient management of our American railway systems, has created the greatest and cheapest transportation service in the world. The search for increased efficiency is continually leading railroad officials to investigate every item of railroading whereby costs may be reduced, service bettered and lives protected. You are all familiar with the strenuous efforts being made by railroad managments to reduce the damage to cars and to goods in transit and to protect the lives of passengers and trainmen. These efforts have been fruitful indeed, but the desired goal has not yet been attained. Damage and loss of life due to end shock is still a serious problem in railroad operation.

Unlocated Damage and Rough Handling are caused directly by end shock. The 1928 report of the A. R. A. Committee on Freight Claims Prevention, calls attention to the fact that charges to Unlocated Damage and carload Rough Handling for the year 1926, showed an increase of approximately one million dollars over the year 1925. For the year 1927, notwithstanding the small net increase for the entire account, again the Unlocated Damage and Rough Handling items reflect an increase of more than a million dollars. In other words, even though the total amount of Loss and Damage Claims paid out in 1927 was less than the amount paid in 1925, there was an increase in Unlocated Damage and Concealed Damage during the two-year period, of more than two and one-quarter million dollars. The report proves that this increase in damage is not due to increased volume of traffic; for, notwithstanding increase in tonnage handled for the past seven years, Losses have continued to decrease, while Damages have steadily increased. The Claims Committee lists 16 causes of loss and damage and shows that for the year 1927, eleven of the causes showed decreases under 1926. Five causes showed increase for 1927 and of these five, three causes are outstanding, namly: Unlocated Damage, Rough Handling and Concealed Damage. The increase in these three causes are reflected in such commodity items as Fresh Fruits and Vegetables, Live Stock, Automobiles, Furniture, Clay Products, Machinery, Glass Articles and Stoves. The loss in 1927, charged to the three undiminished causes reached the staggering sum of more than eighteen and one-half million dollars or about 48% of the total Loss and Damage Charges.

Without a doubt, Gentlemen, end shock in switching and train service, is the direct cause of a high percentage of the freight claims which are classified under Unlocated Damage, Rough Handling and Concealed Damage. The Freight Claim Division has shown remarkable results in reducing the Charges to Loss and Damage. It will be difficult to make further progress until the damaging end shocks are effectively cushioned.

However, the losses caused by end shock also include the damage to rolling stock, which roll up the enormous maintenance charges of modern railroads. Some authorities place the losses due to expensive repairs and shortened life of car equipment, at approximately 150 millions of dollars per year.

End shock must also be charged with injuries and loss of life of trainmen. And such accidents have shown a steady increase during the past few years, in spite of the excellent record of accident prevention campaigns which have so greatly reduced accidents in other departments of railroading. End shocks in switching service are a prolific cause of men falling from the tops of cars and the jerks and shocks in train service often cause serious accidents in the caboose car. The accident record will be greatly improved when train-slack is reduced and the jolts and jerks are effectively cushioned with low end forces.

A shock or blow can be expressed or measured only by means of two units: The unit of FORCE and the unit of TRAVEL. Shock cannot be defined as pounds of force, for shock is energy and must be expressed by a compound unit such as foot-pounds. The factor, TRAVEL, therefore, demands a yielding of the body which is to receive the blow. When a car structure is subjected to an impact, the force acting on the car will be large if the yield is small, but if the yield is made large, the force will be small. Therefore, to effectively cushion end shocks, sufficient yield must be provided so that the force will not be destructive.

With these fundamentals in mind, it is interesting to make a brief review of car construction from the time when automatic coupling of cars was first introduced. This takes us back to the era of wooden cars equipped with spring draft gears. The load-carrying capacity was usually under thirty-tons, and the wood structure of the car formed an excellent cushion against end shocks. In other words, yield was large and force was small. Moreover, we had more time to make up trains; traffic congestions and hump yards were unknown and freight travelled quite leisurely. In those days the draft gear got along very nicely because its function of providing the cushion against end shock was partly done by the car structure and also because operating conditions were not so severe. The economy of larger load-carrying units was recognized and the forty-ton car came into use. Increased traffic developed and operating conditions became more severe. Steel draft arms were introduced because the wood draft sills were continually torn loose from the car sills. Some increase in cushioning capacity was obtained by use of twin-spring and tandem-spring gears, but here again the force factor of the cushioning unit was increased and so it is not surprising to find the introduction of the continuous steel center sills and then the steel underframe. The friction draft gear increased the cushioning capacity by using a tremendous increase in the force-factor of the energy equation. The fifty-ton capacity car brought in all-steel construction and the seventy-ton and hundred-ton cars increased the severity of end shocks due to their increased mass.

Please note that in the evolution of car design, each change toward the modern steel car increased the rigidity of the structure and diminished its ability to yield under end shock. Tracing back through the records of car building practice, we find that prior to 1916, many cars were built with center sills having a sectional area of 16 square inches and were equipped with 5x7 inch couplers and with separate draft-stops riveted to the sills with nine ⅞ inch rivets each. The 5x7 inch coupler was adopted in 1901 and in 1914 the prescribed area of the sills was placed at 24 square inches. In 1916, the decision was reached to change the coupler to the 6x8 inch type "D" which was adopted in 1918. In 1922 the recommended area of center sills, was increased to 30 square inches and 1923 the A. R. A. Committee on Car Construction increased the area of draft gear housing and the number of draft-gear back-stop rivets. The subject is expressed very well in an article entitled "Freight Car Maintenance Problems," published in Railway Mechanical Engineer of September, 1925. The article states in part:

"Changes in the weight and capacity of the freight car have resulted in its increased punishment. Although freight cars have been greatly strengthened to meet the aditional burdens placed upon them, and while there is really no disagreement throughout the country covering the strength requirements of these cars, the railorads do, however, continue to have bad order cars in great numbers. What is actually occurring is increased punishment to freight equipment because of the lack of cushion formerly provided in train movement by reason of the wooden car disappearing. If operating methods are to proceed as in the past, there is absolutely no question but what resilience will have to be furnished through the medium of a suitably designed draft rigging, or else we may expect distinct failure of parts following a progressive cycle, depending upon consideration of relative strength factors. Furthermore, while the freight car, as a whole, has been designed and constructed to meet modern operating conditions, many of its parts are not equal to the tasks imposed.."

The Cycle must be stopped by effectively cushioning the end shocks. Resiliency must be supplied to the modern rigid steel car structure by applying effective cushioning means. Moreover, the bellows-effect of a train of cars must be greatly decreased, in order to diminish the impacts between cars in train service.

A similar review of the development of the draft gear is also interesting. Tracing back to the very beginning of railroading, we find that the means for cushioning the impacts between cars has always been a yielding mechanism or draft gear, located at each end of the car, connecting the draw head to the car. Such an arrangement must necessarily produce train slack. This slack creates the bellows-effect in a train of cars, which is directly proportional to the travel of the draft-gears. By "bellows-effect," I mean that amount by which a train may be bunched or stretched. This is the factor which has always prevented the use of long-travel draft gears. On account of the bellows-effect it has been necessary to confine draft-gear travel within very narrow limits. The development from the early single spring draft-gear, through the twin spring, tandem spring and the friction draft gear, shows little change in the length of gear travel. Increase in cushioning capacity had to be obtained by increasing the force factor of the cushioning unit because the bellows-effect prohibited any material increase in gear travel. The increased cushioning capacity of the friction gear was obtained by using a tremendous increase in the force-factor of the energy equation.

In order to make a proper analysis of the action and effect of end shock it is necessary to divide the subject into two parts; end shocks in switching service and end shocks in train service. In switching service, of course, the damaging end shocks occur when cars are shunted into each other. Such end shocks are buffing shocks. In train service, the shock may be either a buff or a jerk caused by a difference in velocity of adjacent cars, directly proportional to the train slack or bellows-effect.

For switching service, two remedies for end shocks may be suggested. (1st) Decrease the coupling speed. (2nd) Increase the cushioning capacity of draft gears.

Limiting the coupling speed to meet the cushioning capacities of the usual form of draft gear presents difficulties because the switching speed would have to be held considerably under four minles per hour. In fact, the statement has been made that seven out of eight cars in service today are equipped with draft gears which go solid at two miles per hour. And when a draft gear goes solid, it ceases to protect the car. Some idea of the enormous forces which are generated by over-solid coupling speeds, may be had from the results of tests made by the Test Section of the United States Railroad Administration on the Norfolk & Western Railroad. These tests showed that when two 40-ton cars equipped with draft gears, which go solid at two miles per hour, came together at the closing speed, the force was 70,000 pounds, but 2½ miles per hour, an over-solid speed, the force increased to 630,000 pounds. This shows that, after the gears closed, an increase of only ½ mile per hour, or 25 per cent in speed, resulted in an increase of force on the cars of 560.000 pounds, or 800 per cent. Another test was made on two 57½ ton cars equipped with draft gears which go solid at four miles per hour. This test showed that a 370,000 pound force was developed at the closing speed of four miles per hour. At 4½ miles per hour, an over-solid speed, the force amounted to 1,140,000 pounds. This case showed that the 12½ per cent increase in speed, resulted in 770,000 pounds increase in force, or 208 per cent. The tests proved conclusively that after draft gears go solid, they no longer serve their purpose.

With low cushioning capacity it is quite impracticable to hold the coupling speeds to tolerances close enough to be effective. Moreover, even though the great majority of couplings were made at speeds within the capacities of draft gears now in use, a few over-solid blows can cause incipient damage which later may develop into serious curtailment of the life of the car. The ultimate failure of the previously strained parts of the cars may cause serious wrecks with their attendant damage and loss of life.

Some limit, of course, must be placed upon coupling speed. But the limit to be effective must be high enough to permit attainment even under those conditions which involve fast clearing schedules, night switching, unskilled car riders and inefficient hand brakes. Cars must be equipped with cushioning devices having marginal capacity sufficient for protection at speeds even greater than the prescribed limit. Marginal capacity may be defined as that amount over and above the cushioning capacity required for normal or usual coupling speeds. Marginal capacity is of prime importance because the impacts at speeds within the prescribed limit, then will be cushioned by low end forces, while impacts at accidental speeds above the limit will still be within the ultimate cushioning capacity of the gear. Therefore, to reduce end shocks, we must apply the second remedy which is increased cushioning capacity.

I have already called your attention to the fact that it has always been necessary to increase the force factor of the energy equation in order to obtain increased cushioning capacity. The modern friction draft gear supplies about 13,500 foot pounds of cushioning capacity, but since it is limited to about 2¾ inches of travel it must generate a force varying between 280,000 and 370,000 pounds, depending on the type of friction gear. Recalling the fundamental relation between energy, force and travel, it is obvious that increase of gear travel will increase cushioning capacity and still hold the reaction forces within reasonable limits. In fact, the records show that as far back as 1916, the A. R. A. Committee on Draft Gears recommended specifying 4 inches travel and 25,000 foot pounds cushioning capacity as minimum requirements for draft gears. The Committee anticipated that suuch a gear would generate about 450,000 pounds of force on the car structure. However, since draft gear travel determines the bellows-effect in a train, the proposal to increase draft-gear travel was rejected by the convention. The consensus of opinion was that, if draft-gear travel could be held to about two inches, the action of the cars in train service would be greatly improved.

Our analysis of draft-gear requirements must, therefore, include the action of the gears and the influence of gear travel on the relative motion of cars in train service. The 1928 proceedings of the Air Brake Association contain an article on "Relation of the Air Brake to Slack Action and Shocks in Trains." There are listed six factors, which enter into the production of shocks in long trains. Two factors are functions of draft-gear travel. Factor No. 5 is given as slack between cars and Factor No. 6 lists type and condition of draft-gear and attachments. The article brings out many pertinent points relative to the effect of slack on the action of a train. For instance, the statement is made that the amount of shock possible to obtain, increases in severity in proportion to the amount of slack. Slack of itself does not create shock, but if there were no slack there could be no shock. Another statement calls attention to the fact that the slack in a large number of freight trains has reached a point where, under critical track conditions, it is conducive to rough handling, and, in some cases, break-in-twos.

If the air brake operated uniformly on each car throughout the train there would be no force exerted between adjacent cars. This ideal, however, would require not only a simultaneous action of every brake cylinder throughout the train, but it also requires the retarding effort of the brake on each car to be exactly proportional to the gross weight of that car. At present, the retardation on each car of a train is neither uniform nor simultaneous. When the brakes are applied from the locomotive, they apply serially from the head-end towards the rear, which results in retarding the head-end first. The amount and rate of braking effort developed on the head-end of a train, in advance of that developed on the rear-end, determines the impact velocity between adjacent cars. The slack runs in and, other factors being equal, the severity of the resulting end shock is directly proportional to the amount of slack. To some extent, expert manipulation of throttle and air will control the action of slack, but, conditions do arise which are beyond the control of the engineman. Suppose it is necessary to make an emergency brake application. The retardation of the head-end of the train takes effect immediately, the slack runs in and the impact is so great that the train often is buckled. Accidents and fatalities in the caboose are the direct result of such cases. An editorial in Railway Age of November

20, 1926, states that there has been an increase in the number of accidents which results from jolts given to the caboose. This editorial says: "There is more slack in a long train than in a short one and a careless engineman who handles his air or his throttle too suddenly finds the havoc he plays in the caboose increased in proportion to the length of the train." But when an emergency application is required, there is no time for the engineman to control his slack. Quick action of the air brake does not permit the necessary gradual adjustment of train slack. Variation of piston travel, train line leakage, burst air hose, etc., cause bad slack conditions beyond the control of the engineman.

Thus far, I have been discussing the action of end shock on freight cars. The action on passenger trains is identical, except in degree. But since comfort of passengers must be taken into consideration, the question of end shock on passenger cars is of equal importance. Each of you, at some time, has experienced jolts and jerks while riding on passenger trains. Perhaps you blamed the engineman, but heavy trains combined with slack and lack of cushioning capacity were the real causes. Travel comfort will be greatly increased when the jerks and jolts are eliminated by increasing the cushioning capacity and by reducing the amount of train slack to the desired minimum.

THE DURYEA UNDERFRAME presents a revolutionary change in car design. The rigid connection of the center sill to the car structure has been superseded by resilient attachments. The cushioning device does not function as a draft gear because it transmits only the pull of its own car. The pull of the train is taken directly through the center sill. It is now possible to use a long-travel cushioning device because the cushioning means has been separated from the slack-producing means.

The car is designed so that the body and its underframe form a distinct load carrying structure and the center sill forms a distinct buffing and draft column resiliently attached to the body members. The center sill is guided vertically and laterally by the end sills, bolsters and cross bearers; its longtitudinal motion, in relation to the car body and trucks, is resisted by long-travel low-force cushion gears. Standard A. R. A. couplers are key-attached to the center sill in a manner which permits a small longtitudinal movement of each coupler, in relation to the sill. The amount of coupler travel in relation to the center sill is entirely independent of the travel of the sill in relation to the car and trucks. Therefore, slack can be reduced to any ideal minimum and the length of cushioning travel can be increased to the ideal maximum. It is now possible to provide high cushioning capacity by means of long-travel and low end force.

As applied to the box cars built recently, THE DURYEA UNDERFRAME provides about four times the cushioning capacity of the usual draft gear with less than one-half the end force. The cushioning capacity can be varied readily by changing either the travel or the force at will, to suit the type of car and class of service. This permits application of a long-travel, soft cushion for passenger service and caboose cars and high cushioning capacity can be applied to the heavy load-carrying cars.

Standard types of trucks, brake rigging, body superstructure, couplers and other specialties are used.

Since the cushioning device of the Duryea Underframe does not transmit the draft of the train, it cannot correctly be termed a draft-gear. Therefore, it was necessary to coin new terms. The cushioning device which yieldingly resists the motion of the center sills in relation to the car body, has been called the CUSHION GEAR. We have called the attachment of the coupler to the center sill, the COUPLER GEAR. The CUSHION GEARS protect the car and its lading from damaging end forces while the COUPLER GEAR prevents simultaneous action in a train of cars. The coupler travel, relative to the center sills, is made small in order to keep the slack to the desired minimum and this travel is materially less than the travel of the center sills relative to the car body. Therefore, small inequalities of car velocity in train service, are balanced by the action of the COUPLER GEARS. The CUSHION GEARS come into action only when high velocity must be balanced; they are not subjected to that continual action in train service which causes draft gear wear.

The CUSHION GEARS per car are used, attached to each bolster. This arrangement transmits the cushioning force uniformly to the car structure at two places. Similarly the center-sill limit-stops, which come into action only when maximum travel occurs, are so arranged that the over-solid blows are distributed to both bolsters. These limit stops protect the CUSHION GEARS from all over-solid impacts.

In order to give you a better understanding of the construction of THE DURYEA UNDERFRAME, we will now have some slides thrown on the screen.

The stereoptican views are reproduced here and the following description is a summary of Mr. Duryea's remarks:

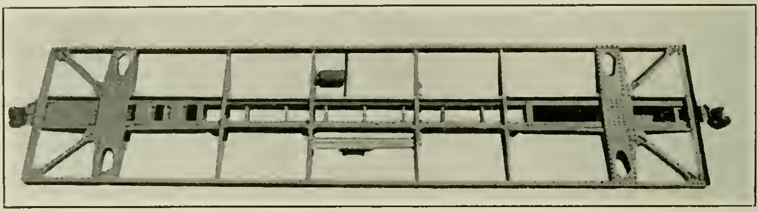

FIG. 1

Figure No. 1 is a photograph of the Duryea Underframe as applied to 2,000 box cars. This design provides a cushioning capacitly of about 54,000 foot pounds with a force of only 132,000 pounds at maximum travel. The loaded car is positively cushioned against violent end shocks, at coupling speeds of 7 miles per hour. The photograph shows the standard A. R. A. construction of side sills, end sills and diagonal braces, permitting the use of A. R. A. body superstructure and floor. Likewise a standard form of brake rigging is attached to the car body and functions in the usual manner. The brake cylinder and reservoir are shown in the photograph, but the rods, levers and brake pipe are not in place.

The bolsters and cross bearers are designed to permit the center sill to move longtitudinally. Rigid floor supports, adjacent to the center sill extend from end sill to bolster and from bolster to the first cross bearer. Between these cross bearers are "Z" bar floor supports which rest upon the top flanges of the center sill channels. This arrangement transmits a portion of the floor load to the center sill and so creates friction. This friction assists the springs in resisting the movement of the center sill and also tends to dampen the coil of the springs.

The operation of the underframe is illustrated by the diagram shown in Figure No. 2. The diagram shows the centre sill at maximum travel, the arrow indicating a buffing force applied at the coupler. Therefore, the coupler gear at the right is shown fully compressed, while the Coupler Gear at the left is in normal position. Reference to the latter, shows the standard A. R. A. type "D" coupler attached with standard 6x1½ inch draft key. The small travel "T" provides movement of the coupler relative to the center sill under buffing forces, but draft forces are resisted by direct attachment of the coupler to the center sill as

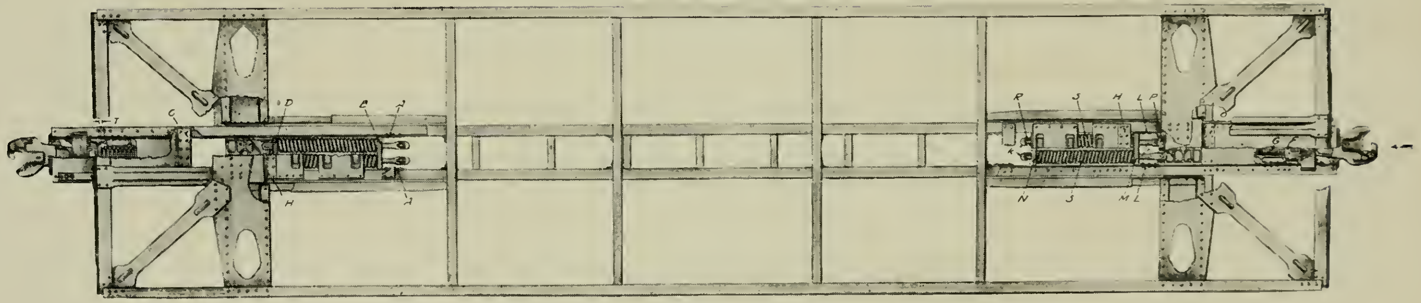

Fig 2

shown. This arrangement keeps the train-slack to the desired minimum and so the bellows-effect in a train is practically eliminated. The purpose of travel "T" is to prevent simultaneous action of the cars.

The Coupler Gear travel is resisted by the powerful Coupler Gear Spring "C" which is under a high initial compression. Incidentally this spring also acts as a positive coupler centering device. Illustrating the action of the buffing force, the Coupler Gear at the right, has been shown fully compressed. The coupler butt is against the following "F," which transmits the buffing force to the Coupler Gear Spring "G" and so starts motion of the center sill through the underframe.

The diagram shows clearly that the center sill is primarily a draft and buffing column which is supported and guided at end sills, cross bearers and bolsters. It can move longtitudinally in either direction through the cross members; this motion being resisted by the powerful Cushion Gears attached to each bolster. Operation of the Cushion Gears is best explained by studying them separately. Begin with the Cushion Gear at the right. The Lugs "L" travelling with the sill, have picked up the front follower "M," compressing the springs "S" against the rear follower "N." The spring force is therefore transmitted to the bolster and hence to the car by links "K" which pass through the springs and connect "N" with the bolster center brace by means of pins "P" and "R." Simultaneously the Cushion Gear at the left comes into action because the lugs "A," riveted to the sill, have picked up follower "B" and compressed the springs against follower "D" which rests directly against the bolster center brace. The links and pins in this position are not in action. This arrangement, therefore, provides a resilient attachment of the center sill to the car underframe instead of the ordinary rigid riveted connection.

Motion of the sils in the opposite direction can result from either a draft jerk on the right hand coupler or a buff on the left. The simultaneous operation of the Cushion Gears would be the same as described except that the links and pins at the left come into action. The links at the right would be inactive; follower "M" now bearing against the bolster center brace.

Limit-stops "O" and "H" are riveted to the center sills and arranged to contact against the bolster center brace when maximum travel of the sill occurs. Thus Figure 2 shows "O" against the right hand bolster which "H" is acting against the left hand bolster. Therefore, these limit-stops which protect the Cushion Gears from oversolid impacts, transmit the impact forces to both bolsters simultaneously. Seven inches of sill travel in both directions, has been provided in the cars which have been built.

The simultaneous action of the Cushion Gears is a distinct advantage. Similarly, distribution of the cushioning forces and also all over-solid impacts to two bolsters is another advantage. In cars of usual design, the bolster adjacent to the acting draft gear, must transmit practically the entire end load to the car body.

The diagram illusrates very plainly that the Cushion Gears are not draft gears since they transmit only the pull of their own car. The draft of the train is taken directly through the center sill. Attention is directed to the fact that since the Cushion Gears pull their own car and its lading only, the sills do not move constantly in ordinary train service. The constant motion of adjacent cars in relation to each other, is taken by the Coupler Gears while the Cushion Gears come into action only when severe impacts occur. Therefore, the guiding surface between sill and underframe are relieved from constant wear.

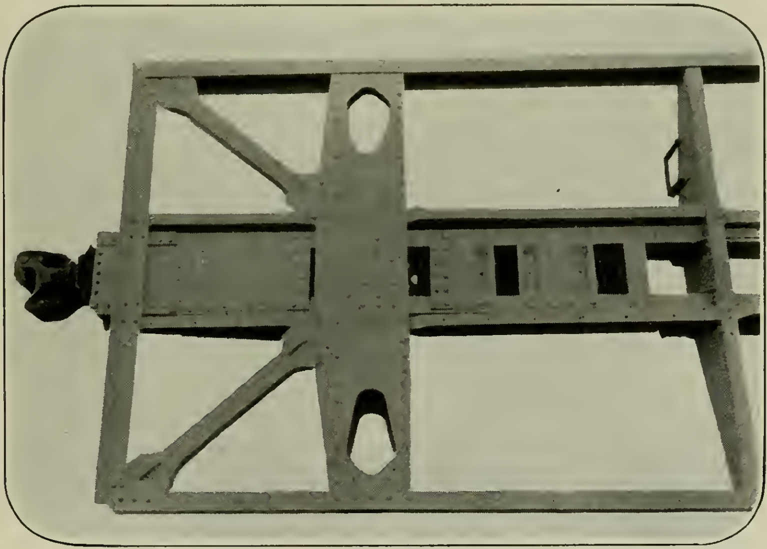

FIG. 3

Figure No. 3 is another photograph showing the construction of the Duryea Underframe in detail. This shows the A. R. A. standard bolster cover plates, end sill angles, diagonal braces and side sills. The method for guiding the center sill at the cross bearers is also clearly shown. Note the center sill limit stops riveted to the center sill channels.

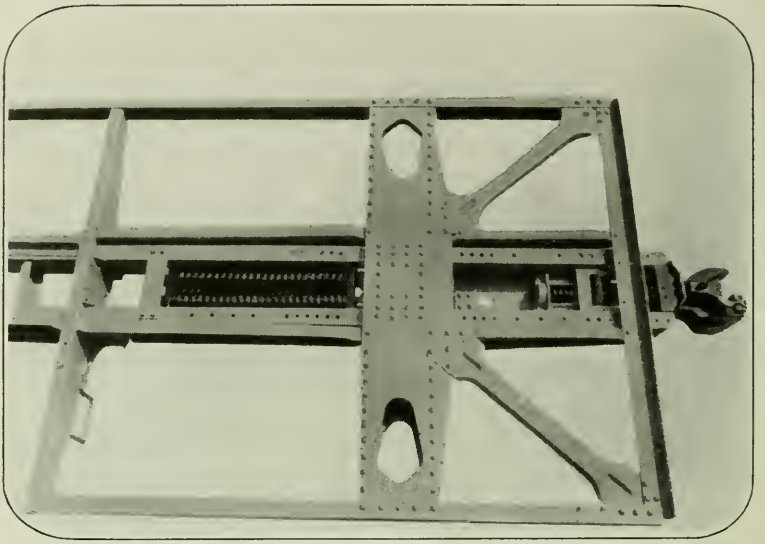

FIG. 4

A detail view of the Coupler Gear and Cushion Gear in position is given by Figure No. 4. In this view the top center sill cover plates and limit-stops are not in place.

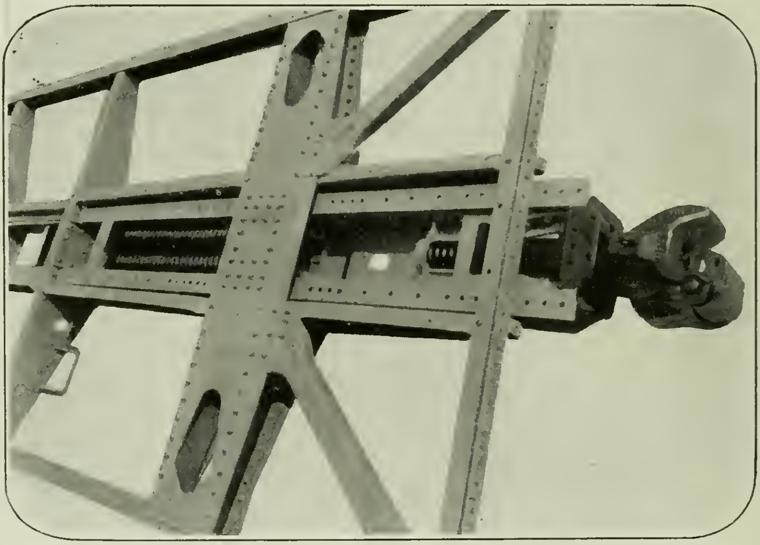

FIG. 5

Figure No. 5 shows another view of the underframe. This pictures the Couupler Gear and Cushion Gear and shows the arrangement of coupler and coupler carrier. The construction of bolsters and cross bearers can be seen.

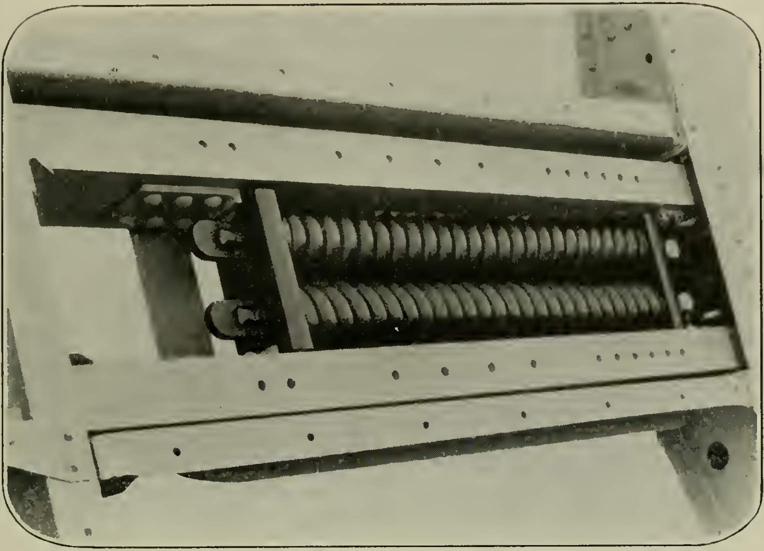

FIG. 6

Figure No. 6 is a close-up of one of the Cushion Gears in

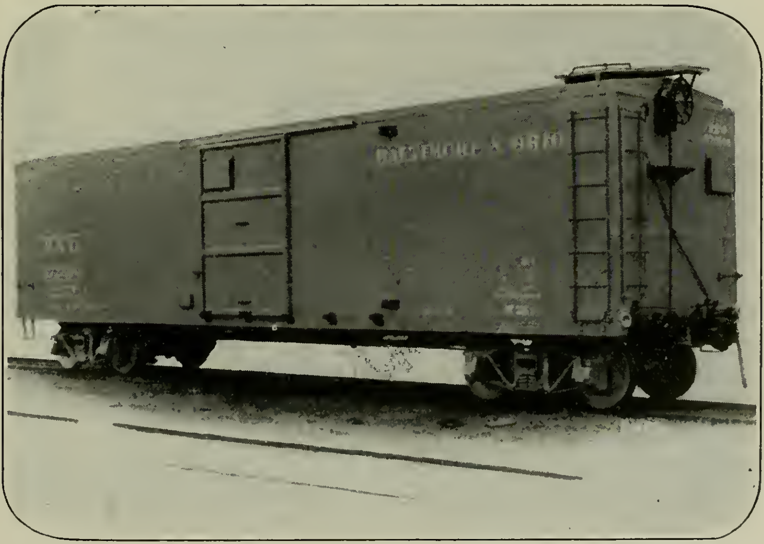

FIG. 7

position showing the follower lugs riveted to the center sill, the ends of the links protruding and the attachment to the bolser center brace through the rear follower.

An exterior view of the 50-ton box car is shown in Figure No. 7. It presents the usual appearance of an A. R. A. type all-

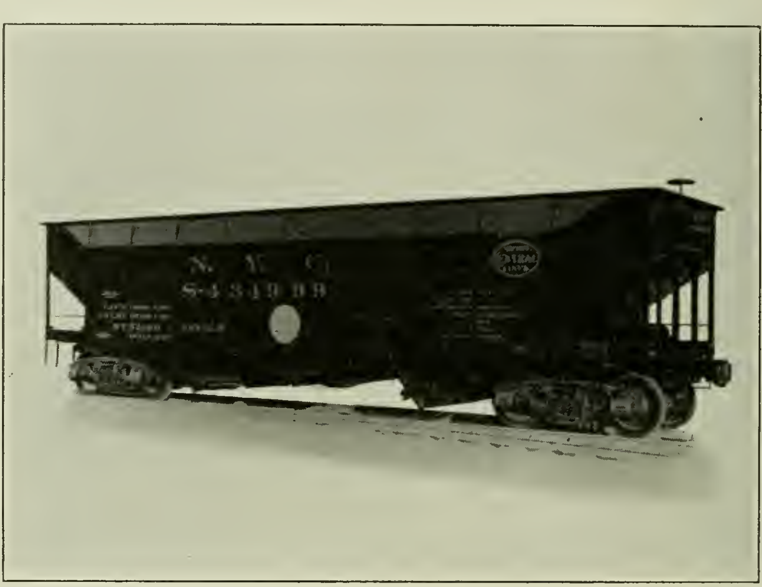

FIG. 8

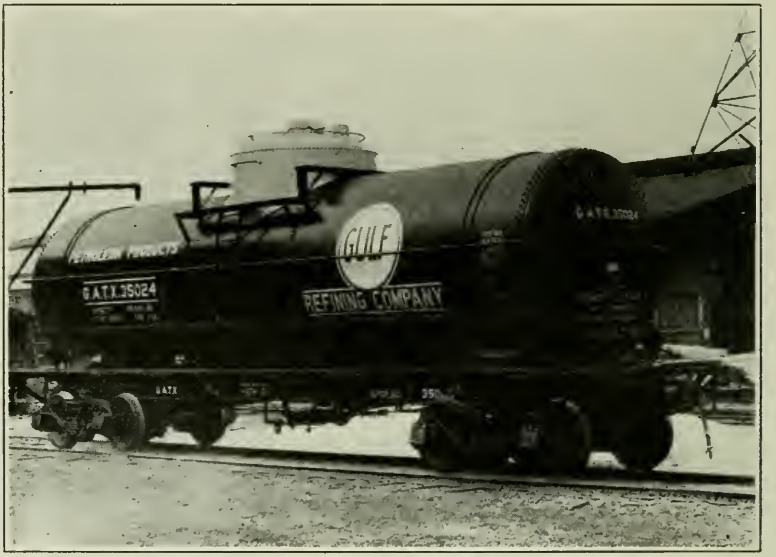

FIG. 9

steel box car. 2,000 of these cars are now in operation on the Baltimore and Ohio Railroad.

Fifty 70-ton hopper cars illustrated by Figure No. 8 have been in operation about 16 months in company coal service on the New York Central Lines.

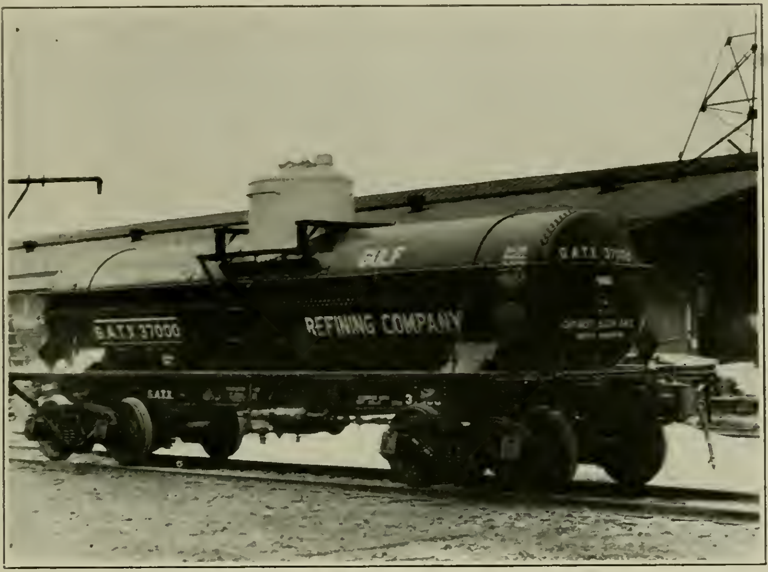

FIG. 10

The Duryea Underframe has also been applied to forty-five tank cars of 8,500 gallon and 12,500 gallon capacity. These cars are shown by Figures 9 and 10.

PRESIDENT: You have all heard a very interesting paper, and if by chance you want to ask any question, or there is something you would like to know more about, I am sure Mr. Duryea will be glad to answer you.

MR. DURYEA: I would like to feel that I have covered it, because it is something that as I have been around the country I have found is quite out of the ordinary and in a number of instances misunderstood. I came here tonight with the purpose of trying to make myself understood and if I have failed in any respect I will be glad to clear it up in any way I can.

MR. R. M. LONG: I would like to ask the speaker what effect it has on starting those heavy trains to take this slack out.

MR. DURYEA: A small amount of travel is provided for at each coupler, in order to prevent simultaneous action of a train of cars. As travel of the couplers in relation to the center sill is entirely independent from the cushion gears provided for cushioning end shocks on the car structure and its lading the travel of the couplers may be made ideally small. Dynamometer tests have been made in starting a train of cars equipped with the Duryea Underframe and an equal number of cars of equal load equipped with a standard draft gear. In these tests the starting of the train equipped with the Duryea Underframes did not compare unfavorably in any way.

MR. LONG: Why I asked that is because we might have difficulty in starting these cars. As I understood the lecturer it would seem to be pretty nearly a solid unit. To lift that load from a standing start would seem to be a difficult undertaking.

MR. DURYEA: I evidently have not made clear the action of the couplers in relation to the center sill. The center sills act as a draft and buffing column extending the length of the car. A coupler is keyed to each end of this center sill and a small amount of movement is provided for between the coupler and the center sill, resisted by a short travel heavy spring. This movement of the couplers in relation to the center sill permits of successive and independent action of a train of cars, so that it is not necessary to start a solid unit. As action of the coupler spring is not dampened by friction shoes, the energy stored in this spring, due to bunching of the cars is largely returned in assisting the car to start. In the event that the engineer has a heavy drag that is difficult to start, instead of bunching his train two or three car lengths as is present practice, he only takes about one turn of his drivers backwards and this bunches about 75% of the train, assuming that the train is made up from 100 to 125 cars and in bunching that 75% he has compressed two of the coupler gear springs between each car. As this energy in compressing the coupler gear spring has not been dissipated through friction shoes when he puts his locomotive into the forward position, each car in the forward end of the train is assisted to start by the 20,000 lb. spring behind each coupler. The forward 75% of his train is largely started by the energy stored in the coupler gear springs by the bunching of the train.

MR. LONG: Just one more question, as to the maintenance of these cars, with all those springs and gears and all that.

MR. DURYEA: In the cars now built and running on the roads we have provided over four times the cushion capacity that the Railroads are using at the present time. It is recognized that when the heavy end shocks to which the present cars are subjected are eliminated that the cause for damage to the car structure and its lading is removed. As end shocks are the direct cause for a tremendous amount of damage and repair bills, by supplying a sufficient amount of cushioning capacity with low end forces the damage caused by end shocks and consequent repairs to the equipment is practically eliminated. High cushioning capacity prevents over-solid shocks. You have seen from the figures which I have just given you how rapidly the end forces increased by adding a speed of only one-half mile per hour above the cushioning capacity of the present gears. The large cushioning capacity of our cushion gears is had with only about one-third of the end load that is now being applied to cars in cushioning shocks. The low end force on the cars means greatly reduced maintainance costs. The cushion gears located between the center sills and the car structure are under a high initial compression and do not take the draft of the entire train behind it; consequently, movement between the center sills and the car structure takes place only when there is a rapid change in velocity which calls for cushioning of the car structure and its lading. The fact that there is very little movement between the center sills and the rest of the structure in train operation removes the possibility of wear. The springs are protected against over-solid blows by ample over-solid stops which contact simultaneous with both body bolsters and as the space that they occupy is not restricted they are designed for a very low fibre stress. They are made of a high grade alloy steel and after being tempered are drawn in order to relieve the strains. There can be no occasion for maintenance of any kind in connection with the cushion gears or coupler gears.

MR. LONG: Just one more question. These cars have run two years that you have illustrated?

MR. DURYEA: These cars are in their second year.

MR. LONG: Is there any noticeable spreading of the center sills?

MR. DURYEA: Absolutely none that I have found. I have looked over these cars at various times and a number of our men have inspected them. There is no reason for spreading as they are well tied together and the forces are low.

MR. LONG: I was very fortunate—or unfortunate—to be one of a Committee of the Air Brake Association that prepared that paper you suggested, and we were much concerned on the topic of stopping and starting trains, just as much starting as stopping. We were concerned in the treatment the cars get in yards, especially over humps, retarding devices on humps where they are used, and I thank you very much for giving us this information.

PRESIDENT: Mr. Lynn, you know something about this.

MR. SAMUEL LINN: With all the engineering experts you have in the room I do not see why you call on an ordinary car man.

Mr. Duryea showed you a New York Central Car. The New York Central Railroad has fifty of these cars running over the Pittsburgh & Lake Erie Railroad to the coal mines and, to the best of my judgment, would say they have been in service approximately two years, and during that time we have had occasion to have one or two of these cars in the shop. Mr. Duryea has probably forgotten that we had one of these cars on which we had to do some light repairs between the bolster and the end sills, however, in my judgment the damage to this car was caused by it being subjected to very severe usage. This is the only car out of the fifty cars to which I have any knowledge of any repairs having been made. I took the matter up a short time ago with Superintendent Rolling Stock J. W. Senger of the New York Central Railroad, located at Collinwood, and he advised me that insofar as he is able to determine they have not had any trouble with any of the cars having the Duryea underframe.

I might say, however, that Mr. Duryea in describing the Duryea underframe under the box cars built for the B. & O. did not bring out clearly that there have been some changes made in the construction of the underframe for the box cars as compared with the underframe under the New York Central hopper cars; in other words, the center sill application is somewhat different from the B. & O. car which was illustrated.

From a maintenance standpoint I do not feel that we have had sufficient experience with this type of car to be able to arrive at any definite conclusions. As stated before, I came here tonight to hear the engineers present ask Mr. Duryea some questions, and I hope they will take a part in the discussion before this meeting adjourns.

MR. DURYEA: I want to apologize to Mr. Long. I did not properly interpret his question as to the spreading of center sills. I saw the car which Mr. Lynn mentions. It evidently had received a very heavy blow as the rivets along one side of the coupler housing had been sheared off and the coupler key driven back in the web of the center sill about 2″. As the rivets in the opposite side had held to the sill this set up considerable eccentricity which caused the one sill at the end to be bent over about 2″ and the opposite side bent outwardly about the same amount. When you spoke of spreading of the center sills, I had in mind that you meant some place between bolsters. This instance could have only been caused by an extremely heavy shock and I did not look upon it as a spreading of the center sill.

MR .LONG: I was very fortunate in putting in nine weeks with the A. R. A. on the Norfolk & Western on that. They tested 115 cars and I saw shock increases go up to 450,000 lbs. We abused those cars in every form we knew to abuse them. With all that we never renewed a rivet in a gear, we never broke a coupler, nor we never pulled out a brace.

PRESIDENT: Mr. Down, of the Westinghouse Company, will you add something to the discussion?

MR. S. G. DOWN: I feel somewhat embarrassed in being called upon to talk on the subject of Draft Gears with so many Draft Gear experts around me as we have here tonight and, therefore, will have to be careful what I say. However, I wish to state that, in my opinion, Mr. Duryea is to be complimented on his ingenuity in the way in which he has worked out the details of the apparatus described to us tonight.

I am sure everyone here is aware of the fundamental fact that you cannot stop a heavy mass in a short distance without shock and this is appreciated by the railroad managements today and they are doing everything they can to provide for the handling of modern traffic with minimum shocks.

Sometime ago, there was described before this Club, a car retarder device, the basic idea of the retarder being to permit breaking up trains and associating cars together again without shock.

Mr. Duryea spoke about the air brake and its action on a train producing shocks and in this connection you will be interested to know much is being done in the way of improving the air brake to smooth out train action in both service and emergency brake applications. An improved form of brake apparatus is now in the hands of the American Railway Association under test and this equipment provides for shortening the time of brake application between the head and rear end of long trains incident to an improvement in the serial acting feature and other improvements that permit of restricting the flow of air to the brake cylinders on the forward portion of the train until the rear brakes start to apply.

Improvements have been made in hand-brake equipment wherein the power applied is materially multiplied before it is delivered to the brake shoes which contributes to an improvement in the handling of cars in switch yards and, in addition to the improvements mentioned for eliminating shocks, Mr. Duryea's apparatus is provided to avoid shocks incident to the absence of the aforementioned improvements to care for same.

Mr. Duryea very properly brought out the basic fact that heavy masses cannot be stopped in a short distance and, therefore, he provides seven or eight inches movement to his draft attachments and I am sure if he could have a greater movement, he would be glad to arrange for it.

I do not feel qualified to discuss Mr. Duryea's draft attachments in detail but in listening to his explanation two questions have arisen in my mind, one being—Do the Draft Gear sills carry any of the carload? and, secondly, what is the effect on the car equipped with the Duryea gear associated with other cars not so equipped in the event of a car or cars bumping into the car having the Duryea gear? In other words, as the Duryea attachment would perhaps not be permitted to move its total travel, would the car receive a detrimental blow?

MR. DURYEA: The center sill is designed as a draft and buffing column. In the box cars as built it acts as a floor support between cross bearers, the floor load being carried by the center sills to the cross bearers into the sides and then to the body bolsters. When one of these cars is associated in a train with other cars having the present form of draft gear, end shocks on our end sills are cushioned by the draft gears at each end of the coupled cars in the same manner that would be necessary if our car were removed from that position. In addition to such cushioning effect as is to be had from the draft gears coupled at each end of the car, our center sills being roughly around 42 feet long, form a resilient column which adds extra cushioning effect to the adjacent draft gears.

PRESIDENT: Mr. W. F. Peck, of the B. & O.?

MR. W. F. PECK: I would rather answer questions on that subject as I am not qualified to talk on draft gears. I conducted tests with empty trains running from 25 to 125 cars and there isn't any question about the method of making the tests. I would be glad to give you the exact details of our manipulation.

PRESIDENT: Professor Endsley, will you add something?

PROF. LOUIS E. ENDSLEY: I remember very well back in 1915 I happened to be chairman of the Committee that asked for 4″ gears to test. Any engineer could figure out that if you increase travel you decrease the final force with the same amount of energy. If you want to keep the same slope of line, which is a thing that affects draft gears, you can get more capacity by a longer travel. I would be glad to hear if in a train of 125 cars, which I assume has about 3½″ per car, if that 437″ is enough to start the train. If it is, that is 1½ revolutions of the wheel. All we need slack for, is to start the train. It would be a fine thing if we could wave a magic wand and make it all one car after it is started. To stop it we would rather not have any slack. But I am somewhat doubtful about starting a train without some draft gear travel or slack. I have observed some of these freight trains starting and unless the engineer takes slack more than half way back, where he is getting two revolutions of the wheels, he stalls if he does not get two or three revolutions of the driver wheels on the present train. It is just a thought that goes through my mind.

This draft gear problem is interesting and all this work that is being done is to reduce the amount of shock between cars. There is no doubt that they will be greatly reduced but I do not know that I will live to see them all taken out.

I was in fourteen yards while a member of the Draft Gear Committee and made records of switching cars, and the average of all those cars was 2.8 miles switching speed. I only observed 11 cars over 7 miles an hour. We do have care in handling cars, much more than most of us think. If they were handling them as rough as many think, we would have 50% of the cars in the repair yards.

I am glad to have been here tonight and I have enjoyed the talk very much. The speaker has made it very clear.

PRESIDENT: Mr. Stucki, would you care to make a few remarks as an engineer?

MR. A. STUCKI: It was a good many years ago that I read a paper on Draft Gears before this honorable body and to tell you the truth, I have forgotten all I ever knew about it. Since it isn't wise to discuss things unless we are familiar with them I have to confine myself to asking a few questions.

Is the coupler fixed or has it some radial movement similar to the standard car construction?

To obtain that essential feature of reducing the draft forces you use twice as many center sills and twice as many draft gears, two with a short travel and two with a long travel. It is therefore quite obvious that the weight and cost of the car is increased somewhat. Can you give us an idea how much?

MR. DURYEA: The amount of radial motion of the coupler is the same as that now commonly used. It is a standard key connected A. R. A. coupler fixed between center sills having the A. R. A. spacing. The weight and cost of our cars are very much in line. In one type of car recently designed we have more rivets and more weight of steel, while in another type we use slightly fewer rivets and a little less weight of steel of a similar type of car of present design. Our box cars ran a little heavier, practically the weight of the cushion gears extra.

PRESIDENT: Mr. DeVilbiss, of the Pennsylvania Railroad.

MR. E. A. DeVILBISS: I do not believe I have anything to add. I came here tonight to listen and I have been very much entertained. It is a pleasure to me to come back to Pittsburgh after five years of absence and meet again with the Railway Club.

PRESIDENT: Mr. Henry, also of P. R. R.

MR. W. C. A. HENRY: I do not believe I have very much to say. I have been interested in hearing of Mr. Duryea's draft gear, and came to find out something about it. It certainly embodies an entirely new principle and one that is interesting and it appears to have great possibilities. An increase in the distance the car body travels with relation to the center sill compared with the present draft gear travel should be helpful in bringing about absorption of shock which is a very important matter.

I would like to ask in connection with the starting of these long test trains of 125 cars, whether they were loaded cars?

MR. DURYEA: The cars were all empty.

PRESIDENT: Mr. Lanahan, may we hear from you?

MR. FRANK J. LANAHAN: If those eminent engineers of brilliant minds and the energetic and capable car men are reticent in discussing the paper tonight, what can you expect of a denizen of the classic precints of McKees Rocks on a subject that is as clear to him as the Einstein theory of relativity?

One strong impression comes to me from Mr. Duryea's paper. It forcefully indicates that we are in an age of transition. All of us are not so fortunate as to be engaged in new enterprises—some of us are associated with old establishments. The problem the speaker engenders tonight reminds me of the two sparrows when first they saw an automobile. The male member of the family, with tears in his little eyes, comprehending the present significance of the invention, turned to his mate and said, "My dear, that puts an end to our meal ticket."

The members of the Railway Club have listened recently to talks on the marvelous discoveries in science and the astounding work in research, while portrayed to us have been the miracles of transportation showing aviation as an assured method of travel from ocean to ocean. Almost unbeliavable are the developments that have taken place. The members of this Club are to be congratulated on having a Program Committee that is so wide awake in keeping abreast of the times. Tonight from their initiative we have a new phase of car construction. From the remarks that have been made in the discussion, it is quite apparent that what Mr. Duryea has presented, is a decided innovation. The gentleman has presented the subject in a clear and comprehensible manner and all of us are glad that the privilege has been ours of gaining information of such a departure in car construction. Undoubtedly he is well versed in his subject and indicates marked knowledge. We members are grateful to Mr. Duryea for his courtesy in coming to us this evening and would be pleased to have him go away with the realization that he has given us a real treat. To bring this home to the gentleman, Mr. Chairman, I move you that a rising vote of thanks of the Club be tendered Mr. Duryea for his kindness this evening.

The motion was duly seconded and prevailed by unanimous rising vote.

There being no further business, on motion, adjourned.

J. D. CONWAY, Secretary.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

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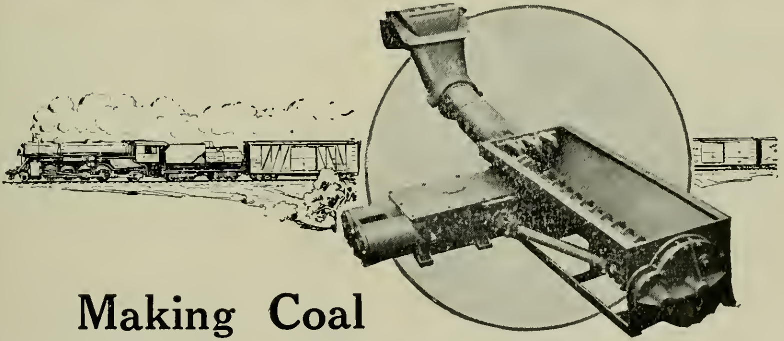

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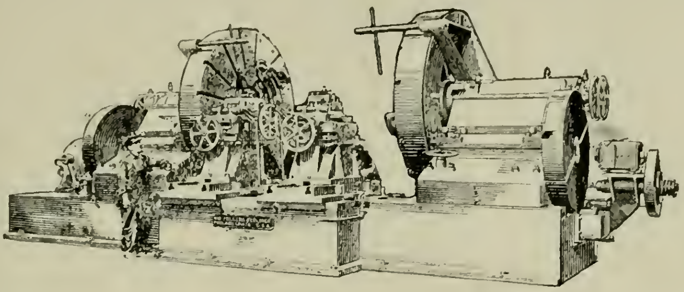

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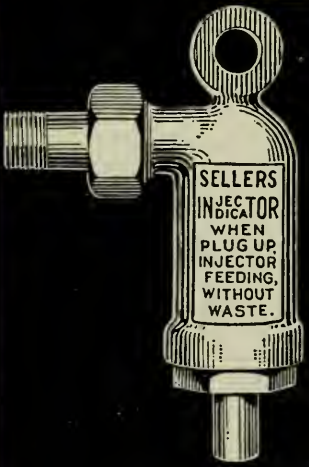

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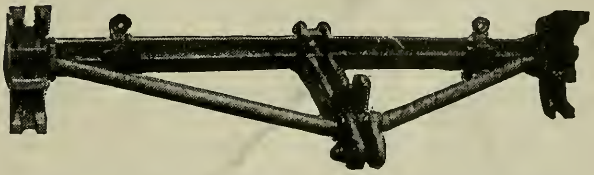

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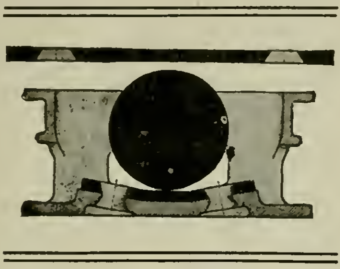

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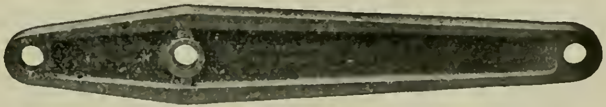

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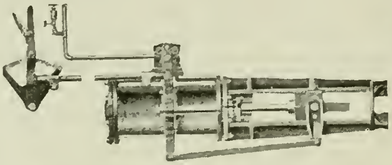

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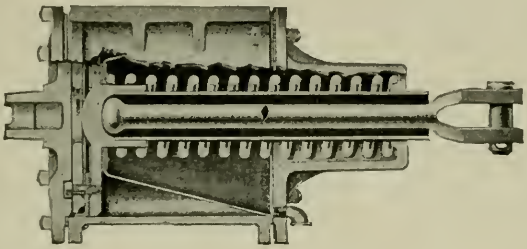

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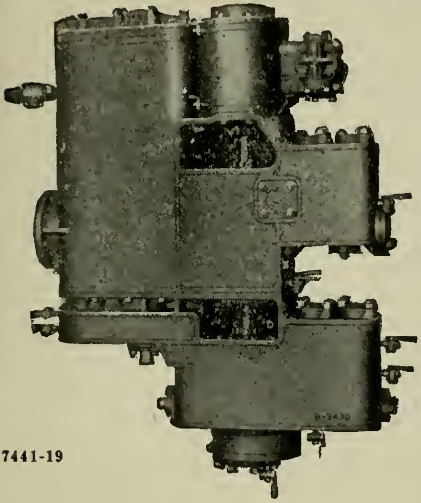

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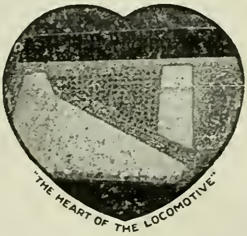

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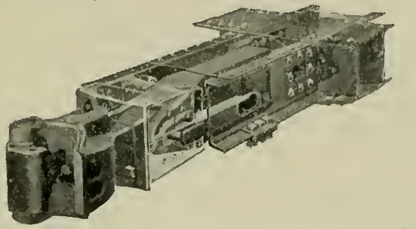

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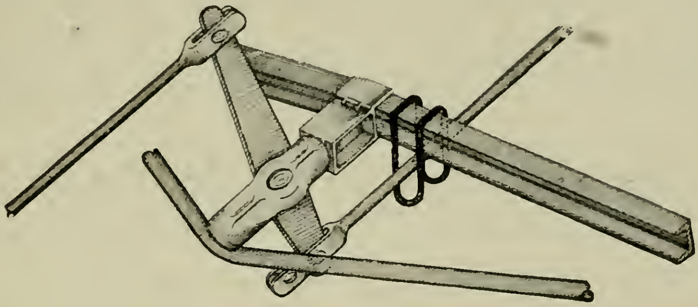

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No. 7

Pittsburgh, Pa., May 23, 1929.

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G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

MAY 23, 1929

The meeting was called to order at the Fort Pitt Hotel at 7:00 o'clock P. M. (Eastern Standard Time) by the Secretary, owing to the absence from the city of President W. S. McAbee. Past President D. F. Crawford was called to the chair.

The following gentlemen registered:

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Cunningham, R. I.
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Diven, J. B.
Donaldson, Warren A.
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Edwards, C. H.
Egan, J. T.
Emery, E.
En Dean, J. F.
Endsley, Prof. Louis E.
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Hilstrom, A. V.
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Howard, L. F.
Huber, H. G.
Hughes, J. E.
Hykes, W. H.
Johnson, E. A.
Keefe, E. A.
Kellenberger, K. E.
Kelly, L. J.
Kelly, J. P.

Ketchpel, Paul A.
Kirkpatrick, R. L.
Kummer, Joseph H.
Lanahan, J. S.
Laurent, Joseph A.
Leckey, Ralph F.
Lewis, Malcolm F.
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Luddy, W. E.
Ludgate, B. A.
Lynn, Samuel
Marlow, G. A.
Merscher, John
Miller, J.
Mills, C. C.
Mitchell, J. G.
Moir, W. B.
Molyneaux, Dawes S.
Morris, J. H.
Moyer, Oscar G. A.
Muir, R. Y.
Myers, W. H.
McCauley, William
McDonald, John
McGaw, W. L.
McHugh, C. A.
McIntyre, R. C.
McLaughlin, H. B.
McMillan, A. P.
McNelty, A. P.
Nieman, Harry L.
Nelson, W. M.
Ness, H. S.
Orchard, Charles
Osborne, W. J.
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Stanford, E. R.
Sterling, C. C.
Stine, D. H.
Stoffregen, Louis E.
Sutherland, Lloyd
Trance, F.
Tucker, John L.
Van Vranken, S. E.
Van Wormer, G. M.
Verret, Roy H.
Warner, E. O.
Waterman, E. H.
Welch, E. M.
West, G. S.
Wheatley, William
White, A. B.
Wood, E. H.
Woodward, R.
Wright, O. L.
Wyke, J. W.
Zilian, R. F.

VISITORS

Battles, D. J.
Beals, R. E.
Bittner, George
Bishop, H. G.
Blose, B. H.
Bone, H. L.
Boyden, J. A.
Brehany, Joseph

Bush, D. A.
Campbell, Harry V.
Carruthers, G. R.
Challingsworth, W. T.
Clark, Homer
Clebansky, J. E.
Cogan, J. E.
Crouser, C. S.

DeLamater, V. N.
Dickson, Kenneth
Dickinson, T. B.
Downes, D. F.
Dudley, J. C.
Durbam, C. W.
Ensheimer, Louis
Evans, William R.
Everstine, A. Perry
Fanard, James
Farley, E. L.
Farrington, Arthur R.
Fendner, G. C., Jr.
Ferree, J. W.
Finucan, William L.
Fouse, Ross G.
Fralich, John S. Y.
Gaking, J. C.
Glass, R. M.
Goodwin, Arthur E.
Haubner, Jacob W.
Heer, Walter
Himmelright, R. J.
Horton, H. R.
Huston, F. T.
Johnston P. B.
Kelley, Sam.
Kemp, E.
Kusserow, Fred W.
Leax, John
Lewis, S. B.
Lintelhurst, James G.
Loughry, R. P.
Manning, J. F., Jr.
Maples, Frank
Martin, J. N.
Masters, Charles
Mattingley, E. H.
Morris, Edgar L.
McClain, Alexander
Newlin, Charles
Olesen, William
O'Neal, M. C.
Oschman, William
Purnell, Thomas F.
Rambo, J. B.
Raub, K.
Reed, M. R.
Reid, James
Rhoads, G. A.
Richardson, E. F.
Rockwell, B. S.
Sayre, F. N.
Shirk, J. H.
Shroyer, J. H.
Smith, Robert B.
Smith, Sion B.
Spindler, D. G.
Spotts, A.
Stout, E. B.
Sohrie, N.
Sullivan, Dan.
Whalen, James J.
Wilson, Lee
Wray, R. W.
Wright, J. L.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Byrne, William L., Carpenter & Byrne, House Building, Pittsburgh, Pa. Recommended by J. S. Lanahan.

Everstine, A. Perry, Accounting Engineer, P. & W. Va. Ry., Wabash Building, Pittsburgh, Pa. Recommended by A. I. Derr.

O'Boyle, Charles M., President, Royal Railway Supply Company, 90 West Street, New York, N. Y. Recommended by J. S. Lanahan.

Wilson, Lee, President, National Power Supply Company, Investment Building, Pittsburgh, Pa. Recommended by E. A. Rauschart.

CHAIRMAN: These applications will be referred to the Executive Committee in accordance with the rules, and upon approval by them the gentlemen named will become members without further action.

Is there any further business? If not, we will proceed to the paper of the evening. We are to have the pleasure of hearing Mr. J. M. Nicholson, Fuel Conservation Engineer of the Atchison, Topeka & Santa Fe Railway, who will address the Club upon the subject of the "Utilization of Locomotives," and it will be illustrated by moving pictures. I have had the pleasure of seeing some similar and perhaps the same films, and I assure you they will be found most interesting. It gives me great pleasure to introduce to you Mr. J. M. Nicholson, who will now address you.

UTILIZATION OF LOCOMOTIVES

By J. M. NICHOLSON,
Fuel Conservation Engineer, The Atchison, Topeka & Santa Fe Railway System, Topeka, Kansas

One of the most important problems confronting railroads today is that of devising means of bringing about a more economical operation. The cost of operation had for a number of years been increased due to higher wages, increased cost of materail, supplies, etc., as well as added legislation effecting the carriers. It is only through further economy in operation that these increasing costs can be met, because the structures governing the rate that carriers may charge for their services does not keep in pace with the increase in cost of the major items, which go into the cost of operation. Economy programs are being followed in every line of operation, and considerable study has been given the utilization of locomotives in order to secure maximum service from each locomotive.

Some 10 or 15 years ago, it was the usual practice among railroads to assign a locomotive to each engineer. This limited the service on each locomotive to that performed by the engineer, which was usually from 3,000 to 3,600 miles per month in through freight service and 1,200 to 1,800 miles per month in main line passenger service. With this operation, a locomotive would lay over at the terminals in most cases from 10 to 24 hours, waiting for the engineer's turn to be called. Less than six hours of this time on an average was required to perform the necessary work on the locomotive, so that the remainder of the dead time was lost. When it was necessary to take the locomotive out of service for heavy running repairs or for general repairs, the crew would be furnished another locomotive, or occasionally would lay off while the locomotive was in the shop. This operation resulted in getting approximately 2,500 miles per month from each locomotive in through freight service, and approximately 4,500 miles per month from each locomotive in main line passenger service.

In order to eliminate the excess time of locomotives awaiting trains after repairs were completed, a program of pooling locomotives was inaugurated, in order that the locomotives could be furnished for service on the first train after the repairs were completed. This in many cases resulted in an increase in miles per locomotive of approximately 25 per cent . This program was opposed by engineers because, in most cases, they would be furnished a different locomotive each trip. This plan of operation was developed to where the maintenance work on locomotives was centralized at one terminal, and the locomotive given only such attention at the turn-around terminal as was necessary to return to the maintenance terminal. From this operation it was developed conclusively that locomotives would make a greater mileage than was made by engine crews, without it being necessary to make repairs to the locomotive.

The next important step was to extend the locomotive runs over two or more engine crew districts, and with this operation, many of the freight and passenger locomotives make from two to three times the mileage made by engine crews. It is not uncommon at the present time for a freight locomotive to make 6,000 miles per month, or a passenger locomotive 15,000 miles per month. Locomotives making this mileage are in productive service approximately 50 per cent. of the time.

The modern heavy freight or passenger locomotive built today represents a first cost of approximately $100,000.00. Correcting this amount for increased cost of labor and material, the same locomotive in 1915 would have cost approximately $50,000.00. This increased cost of investment in locomotives is one of the important reasons for extending every possible effort to increase the utilization of locomotives. Each locomotive saved by increased utilization of existing locomotives results in a saving of this capital expenditure, along with interest, depreciation, taxes, etc.

One of the principal economies resulting from extended locomotive runs is the reduction in cost of locomotive repairs, as well as the cost of handling locomotives, most of which is usually made at the intermediate terminal by a reduction in force. It is necessary at such points to fill lubricators and grease cups, and supply the locomotive with fuel, water and sand. Work performed by roundhouse forces, which is eliminated in through run operation at intermediate points, consists of knocking fires, handling locomotives in and out of the roundhouse, inspecting the interior of the boiler and the machinery of the locomotive, performing such work as is found, firing up the locomotive for service, etc.

The reduction in force that may be brought about by extending locomotive runs will vary with the number of locomotives handled at the intermediate terminal, and the character of work which has been performed at such terminals. With extended locomotive run operation the delayed time of locomotives at intermediate terminals is materially reduced.

It is an established fact that a small number of locomotives making a large daily mileage can be maintained at a lower cost than a large number of units making comparatively low mileage. It is true, of course, that a locomotive making 600 miles per trip will require a little more attention at the end of its run that a locomotive making only half that mileage, and it is also true that the shopping periods will come due in shorter intervals, but these factors are not objectionable. It is recognized that fewer locomotives in service results in less capital investment to move a given business, and in addition, such fixed items as engine handling, fire cleaning, wiping, testing, inspection, etc., will be necessary on fewer locomotives and thus the cost is considerably reduced.

Each locomotive in the assignment on extended runs should have a specific terminal where such locomotive is to be maintained, and the foreman in charge of this terminal should be responsible for its condition. The delay at intermediate terminals and turn-around terminals should be reduced to the minimum and the locomotive held at the maintenance terminal sufficient time to perform the necessary work to place it in condition to make the round trip with minimum attention. This program permits the concentration of repair work at terminals where the most modern facilities can be provided and will effect economies in cost of locomotive repairs, handling of locomotives, and in fuel consumption. The extended locomotive run has obviated the need in many cases for expensive improvements to roundhouse facilities at intermediate terminals.

Many railroads have adopted the policy of making thorough inspection and repairs to locomotives at the time of monthly inspection, placing locomotives in condition to run to the next monthly inspection period with a minimum terminal delay for repairs. This enables quick turning of the locomotives between monthly inspection periods and has resulted in improved conditions of locomotives during this term of service, which increases the amount of productive time during the month.

A number of roads have made trips in excess of 1,000 miles with a locomotive without terminal attention, by placing the locomotive as near in 100 per cent condition as is possible before the trip. This indicates that the locomotive is capable of running over several divisions if properly maintained.

In preparing a modern locomotive for service approximately 3,000 pounds of coal is required to fire the locomotive up and keep up steam pressure while the required terminal tests on the locomotive are being made. There are very few intermediate terminals, where a locomotive is given roundhouse attention that the stand-by fuel consumption is not in excess of 3,000 pounds. With the extended run operation, a large percentage of the fuel consumed at intermediate terminals is saved.

The operation of locomotives on extended runs has developed the need for greater lubricator carrying capacity for valve and cylinder lubrication as well as grease cups and cellars for grease lubrication. It has also brought out the need for improvements in design on parts of the locomotive which tend to reduce the need for repairs, as well as the time necessary to perform such work. Some of the more important items consist of floating rod bushings, solid front end main rod brasses, improved cylinder packing, improved engine truck lubrication, floating hub liners, larger ash pans and increased capacity of locomotive tenders.

To secure the maximum utilization of locomotives, it is important that close co-operation exist between the Mechanical and Operating Departments in dispatching locomotives. This is necessary in order to keep to a minimum the delayed time to the locomotive over the period when repairs are completed and the locomotive is placed in service. Information should be exchanged at least once every eight hours as to power that will be ready and trains to be run, so that the roundhouse foreman may anticipate the locomotives needed and will know that he has a definite amount of time for certain locomotives needing an unusual amount of work. By having a definite time that a locomotive will be needed, the roundhouse foreman can make repairs during this lay-over which would otherwise require holding the locomotive out of service on the next trip.

Another important factor is the reduction in the boiler and firebox repairs brought about by extended locomotive runs due to eliminating the amount of cooling down of boilers and firing up at intermediate terminals. It is generally conceded that the strain set up by cooling down boilers and firing them up is resulting in boiler leaks of as much consequence as the work performed by the boilers. This feature has resulted in an increased mileage between periods of resetting flues on locomotives operated on extended runs.

In order to intelligently supervise the utilization of locomotives, the local and division supervisors should have information showing the average miles per active locomotive per day, in freight, passenger and switch service, as well as information showing the distribution of non-productive time from the time the locomotive arrives at the terminal with a train until again leaving the terminal. It is important that the daily average miles per active locomotive be condensed into a weekly report and, if the mileage shown is lower than the expected mileage for a division, the matter should be investigated to see if there are too many locomotives in service. Such a condition will also be reflected by the reports of non-productive time which will show either excessive time undergoing repairs or awaiting trains after repairs are complete.

The fuel furnished locomotives on extended runs must be uniform in quality and of, as near as is possible, the same burning characteristics. This does not mean that a high grade fuel is necessary, because good results are being secured with a uniform quality of coal of a low grade where suitable grates, ash pans and draft appliances are provided.

Location of coal chute and water stations has an important bearing on the number of hours required to move trains from the initial to the final terminal. On extended locomtive runs it is desirable to have fuel, water and sand facilities on the main line at intermediate terminals where such facilities will avoid having to take locomotives to the roundhouse for attention. This brings about the need for providing facilities, in so far as is possible, which will serve both the terminal and the main line.

To secure the maximum ton miles in freight service or passenger car miles in passenger service, it is necessary that the locomotive be loaded to its maximum tonnage consistent with speed. The factor, gross ton miles per freight train hour, is a commonly accepted measure of locomotive performance in freight service and this item on practically all of the railroads has shown material improvement in recent years. Considerable improvement in the speed factor has been made as the result of reduction in delayed time between terminals.

In switching service the engine and yard crews are assigned to eight hours' work. Locomotives in many cases are working two and three consecutive eight-hour tricks before being turned into the roundhouse for repairs. This program materially increased the utilization of switch power and, where crews are changed in the yards, a material saving is made by avoiding the need for the locomotive moving to and from the yard to the enginehouse. Considerable fuel saving results from this operation in that, with the ordinary quality of coal, locomotives can work 16 to 24 hours without having to clean the fire.

It is the policy of railroads to follow a progressive program in securing new locomotives, and retiring obsolete locomotives, or locomotives which no longer meet the service requirements. New locomotives are purchased primarily to bring about a reduction in cost per unit of transportation, giving special consideration to reduction in cost of repairs and fuel consumption. It is found that in most cases new locomotives bring about substantial reductions in these costs, and in order to realize the maximum return of investment therein, the practice is to place new locomotives on extended runs, or where maximum utilization may be obtained. The maximum use of modern locomotives reduces to a minimum the use of older and less efficient ones.

The operation of extended locomotive runs is now quite general on all railroads, and is a subject given much thought and study during the last five years in both passenger and through freight service. Extended locomotive run operation does not lend itself as readily to main line local passenger and freight service, or branch line passenger and freight service as to through service. Many local and branch line trains are handled by pooled and regularly assigned locomotives, because of the fact that they are so scheduled, it is impossible to secure additional service from the locomotives handling these trains during the layover period.

The Santa Fe Railroad is at present operating 21 extended locomotive runs in freight service over two, three or four engine crew districts. This operation in practically every case covers the entire through freight service. The longest run is between Wellington, Kansas and Clovis, New Mexico, a distance of 417 miles where four engine crews are used on a Mikado type locomotive burning fuel oil. The longest coal burning run in freight service is from La Junta, Colorado, to Albuquerque, New Mexico, a distance of 348 miles in which three engine crews are used with a Santa Fe type locomotive. In passenger service 22 locomotive runs are operated with from two to five locomotive crews and these runs involve all of the through passenger trains. The longest run in oil burning service is from Kansas City, Missouri, to Clovis, New Mexico, a distance of 678 miles in which five crews are used. The longest run in coal burning service is from La Junta, Colorado, to Winslow, Arizona, a distance of 637 miles in which five crews are used.

The policy of the Santa Fe Railroad is to increase the number of extended locomotive runs, and a gradual improvement is being shown in the average miles per active locomotive. This program has also resulted in economies in cost of locomotive repairs, handling of locomotives and fuel consumption.

The motion pictures to be shown at this time were prepared by the Santa Fe Railway Company under the direction of Mr. John Purcell, Assistant to Vice President. These pictures consist of two reels, one on "Steam Generation and Operation of the Locomotive," and the other on "Terminal Handling of the Locomotive." They were prepared for the education of employes and have been shown at 90 meetings on the Santa Fe System with a total attendance of 7,960, or an average attendance of 89 per showing. The pictures have also been shown before 13 conventions similar to this, including Railway and Engineering Clubs, as well as Universities, with a total attendance of 5,650.

These pictures were prepared primarily for the education of the young men in engine service, as well as those in Locomotive Department service. The story told by these pictures aids in the education of such employes. The same information is available in various text books, which are studied by these men. The pictures create a lasting impression on the minds of the younger employes, which will be beneficial to them if they continue in railroad work, as it is said an average individual remembers about 15 per cent of what he reads, and 85 per cent of what he sees. They are also valuable in the education of older employes, whether directly or indirectly connected with locomotive work.

The locomotive shown in these pictures is the standard Mikado type locomotive used by the Santa Fe Railway Company in freight service, on so-called low grade territories. These locomotives are equipped with feed water heaters, superheaters, brick arches, air operated fire doors, mechanical stokers, cross compound air pumps, steam operated grate shakers, and other modern locomotive devices. This class is the standard freight locomotive from Chicago west as far as La Junta, Colorado, Clovis, New Mexico, and Galveston, Texas, also on the territory from Belen and Albuquerque, New Mexico, westward to Winslow, Arizona. Trains varying from 70 to 150 cars, or from 3,000 to 6,000 tons are handled by these locomotives over the various grades encountered through this territory. This class of locomotives has a tractive effort of 63,000 pounds, wheels 63 inches in diameter, cylinders 27x32 inches, and a grate area of 66.8 square feet.

The reel of picture covering "Steam Generation and Operation of the Locomotive" enables one to visualize what takes place inside of a locomotive by following the steam from the time it is generated in the boiler until it is transformed into useful work and exhausted through the smoke stack of the locomotive. It is an animated picture made from drawings, and a model consisting of celluloid moving parts. The picture also emphasizes the importance of working a locomotive at the shortest cut-off possible in order to secure maximum work from the steam generated. Explanations are made by titles, so that none are necessary as the picture is being shown.

The second reel covers the various operations which constitute the handling of a locomotive from the time it reaches the terminal until the locomotive is again ready to be dispatched from the terminal with another train. This picture features the proper loading of coal on the tenders, correct blocking in roundhouses to avoid locomotives moving out through the walls or backing onto turntable pits, the importance of draining condensation from cylinders, etc.

CHAIRMAN: We have listened to a most interesting paper and we have seen a very interesting set of films. The paper is now before you for discussion. Mr. Nicholson will also be glad to answer any questions that may arise in connection with the subject.

I think Professor Endsley is in the room, and we would like to hear what he has to say on the subject.

PROF. LOUIS E. ENDSLEY: A statement was made by the speaker regarding the damage done to a boiler from heating it up and cooling it off, as compared with continuous running of it. There isn't any doubt at all that every time you heat a boiler up and cool it down again you do it more damage than if you had kept it warm for a good many miles of running. It has been proved true very extensively. On one road from which I heard less than a month ago they had been able to get two and a half times the service from a fire box from extended runs as compared with the old engine running only on one division and each time they come in the fire is dumped, the sheet cooled off and then warm it up again. Every time you do that the staybolts in the front and back of the fire box are loosened due to the strains set up by the cooling and heating.

These are some of the things which have made the life of a locomotive boiler, if not greater in years, greater in miles, which is the same thing when we come to think of it. Running locomotives over 600 miles is proving very economical. They are doing that now. I do not see why we should not have thought of it a great many years ago. We have stationary boilers and engines that run a good many days without stopping. Of course putting a locomotive over the road is harder on it than keeping it stationary in a power plant, but nevertheless all these things are going to make savings for the railroads and less power is necessary.

I was very much interested in the film showing just how the locomotive is operated. I would like to have had that when I was teaching. I do not like, however, the gobs of steam going out the stack. I will have to take exception to that. That is a theory that has been refuted a good many years ago. Possibly the fellow making the picture did not know that.

I enjoyed the paper very much. I had the pleasure once of riding 480 miles on one of their trains behind the same locomotive, and we went into every terminal exactly on time.

CHAIRMAN: Mr. Berg, you have had some experience along these lines. Perhaps you could tell us something abiut it.

MR. KARL BERG: Mr. President, I do not think I can tell anything more than has been said. I might profit individually by asking some questions.

First, I would like to ask what the ratio is of locomotives in actual use as compared with all those owned, including the ones undergoing repairs. That is quite an item of cost on a good many roads. And what is the cause of the large number lying around in addition to those in actual use?

I noticed some things in the pictures that I would like to ask about. The cleaning of a locomotive, using oil in connection with water and air, does that not leave a certain oily film on the surface of the locomotive, which in turn picks up more dirt? I know some railroads that have abandoned the use of oil and instead use a cleaner which leaves a dry and clean surface, not an oily surface.

Another question, if I may ask it. I would like to know why the upper portion of that steam pipe was painted white? What is the object of that?

MR. NICHOLSON: I am not altogether sure that I understand the question of engines owned and in service. Do you mean the number of locomotives assigned to extended runs and the proportion they bear to the total?

MR. BERG: The number of locomotives actually working as compared with the ones owned, including those that are in for repairs. In other words, how many locomotives is it necessary to own in order to do the actual work required?

MR. NICHOLSON: On our road we have slightly in excess of 2,000 locomotives. We have a business that is very seasonal. Our heavy business comes in the fall when grain is moving and when fruit and oil are moving. Right at this time we have in excess of 300 locomotives stored in good condition. We have around 10 per cent in the shop for heavy and general repairs. That is approximately 200 locomotives. That means that we have around 1,400 locomotives in active service. Of these 1,400 locomotives about 60 per cent are in extended run service, and 40 per cent on short runs.

The cleaning of locomotives with oil, water and air is a development from the time during the World War when we could not get men to do the work. It was done then as a necessity and we had considerable trouble in getting an oil that would dissolve the dirt and clean it off in a way that would not leave a film of oil to collect dirt after the engine had been cleaned. The condition you speak of exists to some extent, but with proper handling and proper oil it can be largely eliminated. In this connection, I might state that tanks and jackets are in some cases rewiped with waste in order to get a cleaner surface. We have been quite successful in doing the cleaning without rewiping.

With regard to the stand pipe being painted white. That is a galvanized iron spout and is the way it shows up in the photograph.

CHAIRMAN: Mr. Reed, of the Pennsylvania Railroad, has had some experience in this line. We would like to hear from him.

MR. M. R. REED: I am just a visitor this evening. I came quite a distance principally to see my good friend Mr. Nicholson, with whom it has been my pleasure to be associated for some three years or more in this very interesting work of the American Railway Association on the utilization of locomotives. I do not think there has been anything undertaken by the American Railway Association in a good many years that has been so interesting and productive of so much good to the American railroads in general as this subject of the utilization of locomotives. I do not care how well laid out or how good terminal facilities may be, road facilities may be, or anything else, the fact still remains that a railroad can only do what its locomotives can do. The utilization of locomotives has been productive of more good and more economy than anything that has been attempted by the railroads in a good many years.

Paradoxical as it may seem, the most economical and the best results are obtained from wearing out your locomotives as quickly as possible. It simply means that you have obtained the possibilities of that locomotive in the shortest possible time. And it goes without saying that if your engine is out on the road pulling cars, where it ought to be, instead of lying around terminals spending money on it and burning up fuel that is doing no good, we are not getting out of the investment anything like what we should.

I think it was pretty generally the case a few years ago that we were getting anywhere from 25 to 30 per cent of the possible number of hours out of the 24 in the utilization of our locomotives. I think today we are getting close to 50 per cent on the average. That seems a wonderful saving. I think the close attention that has been paid to the utilization of locomotives has resulted today in most large systems having a great many stored locomotives. It means that we are doing the same amount of work, or an increased amount of work, with the same or a much smaller number of locomotives. We have relegated obsolete locomotives to the storage pile and have used the modern more economical locomotives to conduct the business. I think a great many of us today have enough locomotives in storage to operate a pretty good size railroad. We simply have to maintain that many less locomotives with less expense, which means a more efficient performance in operation. And it is economy in operation that we have had to look to in the past few years for net earnings on our railroads, instead of increased gross.

Everything Mr. Nicholson has presented in his paper is pertinent and important to this whole subject and is absolutely true. There isn't any good reason why the machinery in a locomotive will not run over the longest extended lines now in existence. There isn't any good reason why the boilers will not run. The principal factor in extended locomotive running is firing conditions. Those conditions are not hard to meet, as I see it. There are wonderful opportunities in the increased utilization of our locomotives if we will look at it squarely and take time and effort and courage to analyze them and to go through with the job.

There are certain prejudices to overcome, no doubt. As an example of that I might state—and Mr. Nicholson will recall the incident—we were making a field survey on a certain railroad and a motive power official said to us, "Why should I run an engine 200 miles when I have two engines that I can run 100 miles each?" Whether you get the full import of that right off I don't know. But there is one of the things that has affected and impaired in some instances the economical operation that was to be obtained through the fuller utilization of locomotives.

There are advantages in other directions to be obtained rather than, or in addition to extended locomotive runs. It may not always be possible to run engines two or three or four crew districts. Take yard service for instance, or local service. If we can get more hours per day from the engine where we can not get extended runs, we are accomplishing the same result, as far as that particular phase of the service is concerned.

I am very enthusiastic over the whole subject. I have been in it deeply enough to realize and appreciate the marvelous possibilities that obtain on the railroads in a careful analysis and study and application of these principles. I hope every railroad man here tonight will get something and appreciate what these possibilities are and will help to carry them out. I thank you.

MR. J. E. HUGHES: I would like to ask how much time you allow at intermediate terminals for turning freight power?

MR. NICHOLSON: We follow different practices at intermediate terminals. At some freight terminals the locomotive goes through with the train. The time the train is in the terminal will vary from 20 to 40 minutes. At other points we relay, taking a locomotive off the first section of a train and putting it on the following train. I might state that we are about half and half between relay and through operation. In clinkering coal territory about 40 minutes' delay is the best that can be done if it is necessary to clean the fire.

MR. WILLIAM C. HANSEN: Several years ago I heard Professor Goss read a paper on the utilization of exhaust steam to propel a fan which would exert an even pull on the fire. He said one of the disadvantages would be maintaining the bearings. Being an interesting paper it has stuck in my mind and I am wondering if anything has ever been developed along that line.

MR. NICHOLSON: I am familiar to some extent with a plan of that kind which was worked out on our railroad some 10 or 15 years ago. We had a turbine-driven fan that would take the products of combustion from the front flue sheet and put them out through the stack, allowing the exhaust steam from the locomotive to go to the atmosphere with very little back pressure. This turbine was driven by live steam. I understand in foreign countries they are doing this work with exhaust steam, but I have never seen an application of that kind. The Texas Pacific have experimented with fan pressure air delivered under the grates. The plan of reduced draft seems to have fallen by the wayside primarily because of the cutting action of cinders being so great that the fan cuts out in a short time.

CHAIRMAN: Mr. Cannon, of the P. & W. Va. We would like to hear from you.

MR. T. E. CANNON: I have nothing to say at all. Running locomotives through is the real thing to do where it can be done. And where it can be done it is the proper thing to do. Six hundred miles is out of the question with us. We can run a freight engine 200 miles and would run them farther if the conditions would permit it. What we are doing it took years and years to reach.

CHAIRMAN: Mr. Flinn, of the P. R. R.

MR. R. H. FLINN: I do not know that I can add a great deal to what has been said by Mr. Nicholson and Mr. Reed. We are in the unfortunate position of being in a territory in Pennsylvania where we can not get the length of freight locomotive run that Mr. Nicholson has and for that reason we can not get the results he speaks of. We are in a district that depends largely on coal and our runs are short. In the territory west of Pittsburgh we have succeeded in getting a run of 206 miles. That is the longest freight run we have out of the Pittsburgh district. When we get to Altoona we cannot run the same locomotive through because with the different tonnage and grade requirements on the divisions we have to operate over, a different type locomotive is required for most eceonomical results. I think the long locomotive run will be developed further in the next few years, but we cannot just at present see our way clear to do it in this territory.

There is no doubt at all but what there is a great deal of economy in both repairs and fuel consumption in not only the long locomotive run but what goes with it, namely, increase in average locomotive miles per month. While we are trying to develop long locomotive runs, we are in the meantime making vigorous effort to keep down the number of locomotives in actual service. For instance, we have concentrated our work in our principal terminals, as Mr. Nicholson has suggested, with the idea of not only taking care of the work where we have the best facilities for doing it, but reducing the number of locomotives out of service for boiler wash attention and performing, in addition to the routine work which we are required to do once every thirty days, sufficient additional work to put the engine in condition to run for thirty days with a minimum of turn-around attention. By this process we have been able to materially reduce the number of locomotives out of service in the enginehouse for daily attention, with the result that out of a given number of locomotives we have a greater number available for actual service and accordingly can handle the business with a less number of locomotives in the field and at the same time we get an increase in our average locomotive mileage, this increase having been about twenty-five per cent. in the past two or three years; all of this without the benefit of the long locomotive run. If we could get three hundred or four hundred mile runs to go with this we could get somewhere on the average mileage proposition.

The subject is most interesting. It is one in which not only the mechanical department but the transportation department ought to take a great deal of interest in. It all comes down to this—you have got to have locomotives available to haul the traffic when the traffic offers. Unfortunately in the coal mining territory, particularly, there is a slack period during the early part of the week and heavy period during the latter part. You will have to have enough power to haul the business during the heavy part of the week which will be more or less idle during the early part of the week. If we could equalize that we would be very much happier. We are endeavoring by close co-operation between the two departments to balance the one against the other as closely as we can in order that there will be available power to haul the traffic but not have any more power in service than is absolutely necessary.

We endeavor to keep our engine house shop list as low as we can during the days of heavy business and adjust matters by letting it run up higher during the lighter periods. There is a great deal in the whole problem that is well worth the attention of every railroad man who has anything to do with the operation of trains and locomotives.

MR. HUGHES: I would like to ask another question, if I may. Where you have yard power working continuously 24 hours, are you in favor of peddle service, or supplying refueled and hostled engines for your yard service on the job?

MR. NICHOLSON: What do you mean by peddle service?

MR. HUGHES: Peddle the engine that has been hostled and refueled to the point where assignment is working and exchange for the engine requiring hostling and refueling which is brought to the pit and prepared immediately for another assignment, until the district is covered, resulting in continuous yard service on the job.

MR. NICHOLSON: We do very little of that. Our usual practice is to take the 8 P. M. switch engine which turns in at 4 and make a yard change of crews on the 4 o'clock trick. If the engine works a lead trick the crew will change at 4 o'clock and again at midnight in the yard. The third man will deliver the engine to the round house. But if the round house is a considerable distance from the yard, where there is objection raised by the crew to getting an engine one place and turning it in at another, we will send a hostler to deliver that engine from the yard to the round house.

MR. HUGHES: That is what we term peddle service.

MR. NICHOLSON: We have some of that where our yard is a considerable distance from the round house.

One thing I want to make clear in connection with another question with regard to relay operation, I want to leave with you the thought that this is freight service only. Passenger locomotives on our road are not relayed. We have three locomotives handling trains from Kansas City to Los Angeles. They operate between 500 and 700 miles on the same train. Mountain type locomotives are used in mountain territory and a Pacific type locomotive is used on low grade territory.

MR. HUGHES: How many active hours do you get per day from your yard engines?

MR. NICHOLSON: We get as high as 24-hour service on some assignments. We have others that only work one shift. There are points where only one switch engine trick is operated in a period of twenty-four hours. Our average over all is around 15 hours service per day, some of which is 24 and some of which is 8 hours.

CHAIRMAN: Are there any other questions?

MR. SAMUEL LYNN: Probably I should keep my seat. This seems to be a matter in which the locomotive and transportation members are largely interested. However, I feel that every officer and employee of the railroad is interested in this subject. As I get Mr. Nicholson's paper, he is working for what we are all working for and that is efficiency and economy. There have been a good many questions asked and answered and I believe the only thing which remains is for me to make a motion to pronounce the benediction. I have enjoyed Mr. Nicholson's paper and I am very sure every one in the room will join me in saying that it has been a privilege to hear it. Therefore, I would like to move that a rising vote of thanks be extended to Mr. Nicholson as an expression of our appreciation.

The motion prevailed by unanimous vote.

There being no further business, meeting adjourned.

J. D. CONWAY, Secretary.

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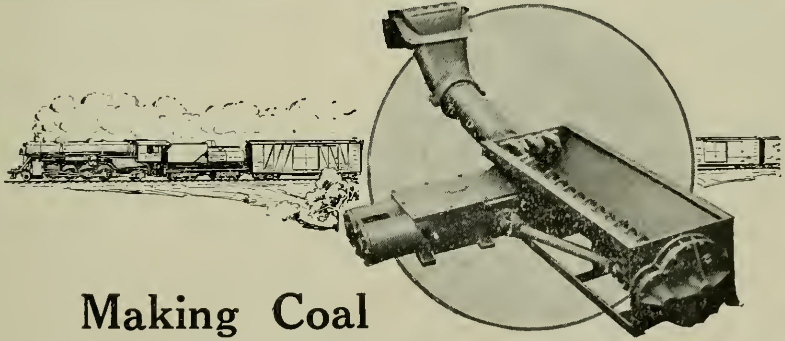

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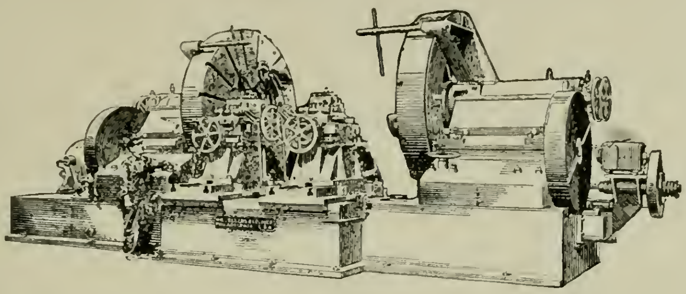

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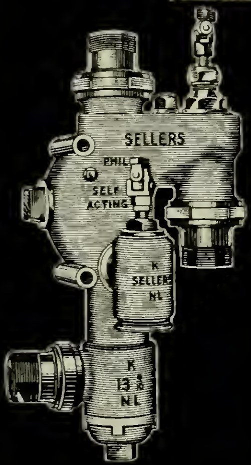

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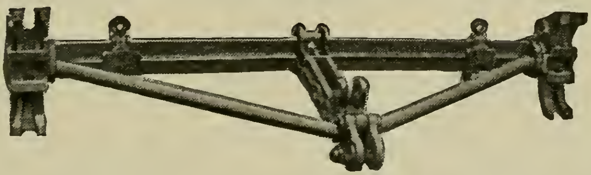

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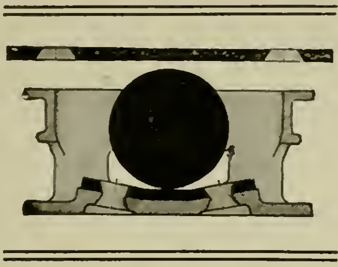

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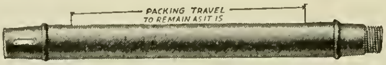

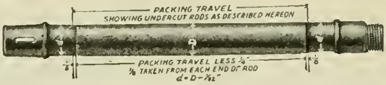
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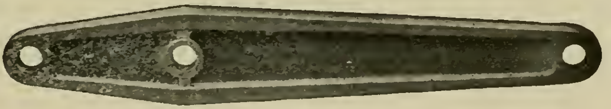

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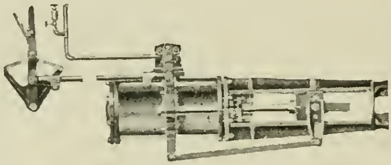

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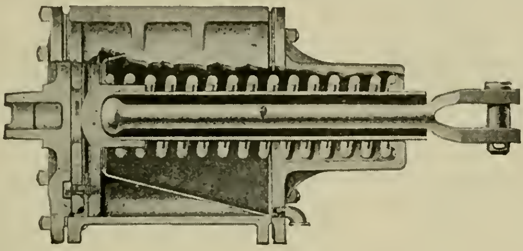

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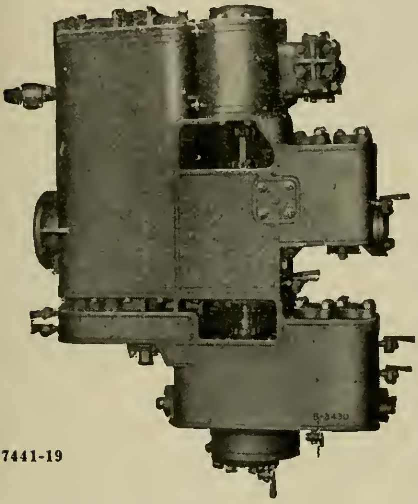

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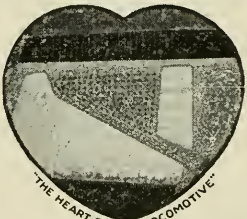
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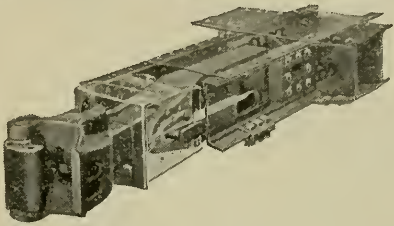

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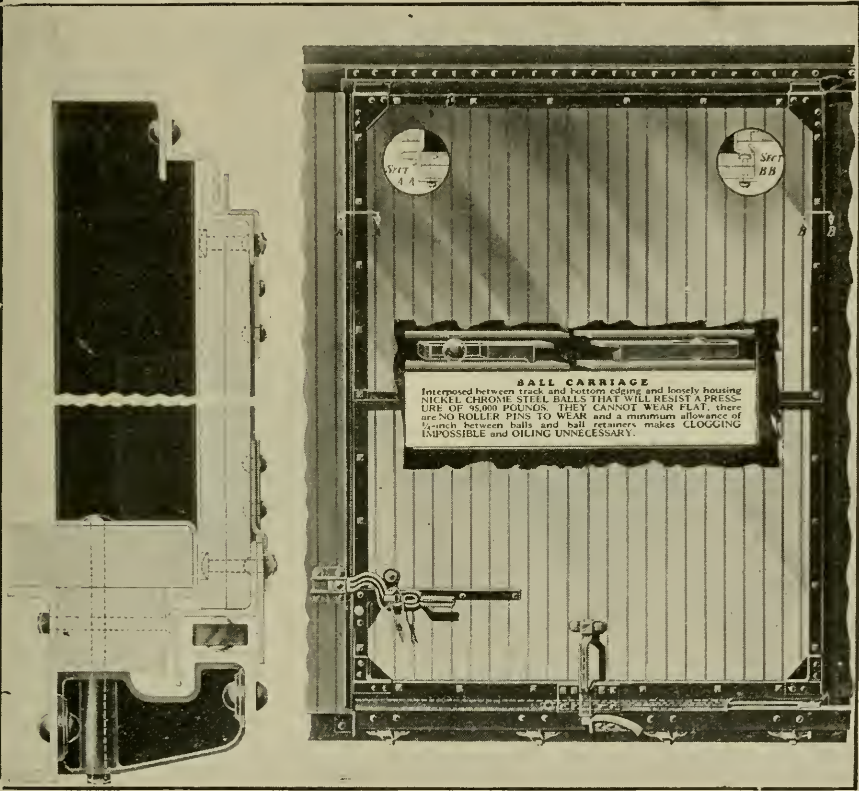

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Organized October 18, 1901

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Past Presidents

*J. H. McCONNELL	October, 1901, to October, 1903
*L. H. TURNER	November, 1903, to October, 1905
F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
*D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
*J. A. SPIELMANN	November, 1918, to October, 1919
*H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926
G. W. WILDIN	November, 1926, to October, 1927
E. J. DEVANS	November, 1927, to October, 1928

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
SEPTEMBER 26, 1929

The meeting was called to order at the Fort Pitt Hotel at 7:00 o'clock P. M. (Eastern Standard Time), with President W. S. McAbee in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Allen, Harvey
Altsman, W. H.
Ambrose, W. F.
Ashley, F. B.
Babcock, F. H.
Bair, J.K.
Balzer, C. E.
Beam, E. J.
Bednar, J. J.
Blest, Minot C.
Bowen, James T.
Brinkhoff, W. H.
Bull, R. S.
Byrne, W. L.
Campbell, J. E.
Carlson, Frank R.
Carlson, L. E.
Carson, John
Carter, William
Cipro, Thomas
Conway, J. D.
Cotter, G. L.
Coulter, A. F.
Craig, John R.
Crawford, D. F.
Crenner, Joseph A.
Croke, Thomas F.
Davis, Charles S.
Dempsey, P. W.
Dickinson, F. W.
Diven, J. B.
Duryea, O. C.
Eckes, J. M.
Edwards, C. H.
Eichhorn, T. F.
Emerick, J. B.
Endsley, Louis E., Prof.
Evans, E.
Everstine, A., Perry
Farrel, G. R.
Fisher, H. G.
Fisher, J. J.
Flinn, R. H.
Geisler, Joseph J.
Glessner, G. P.
Goda, P. H.
Gray, Guy M.
Gunnison, W. L.
Haller, Nelson M.
Hansen, W. C.
Herrold, A. E.
Holmes, E. H.
Hoover, J. W.
Hughes, John E.
Kelly, L. J.
Ketchpel, Paul A.
Keys, A. H.
Kinney, T. F.
Knox, William J.
Lanahan, Frank J.
Landis, William C.
Laurent, Joseph A.
Lawson, A. F.
Lobez, P. L.
Loeffler, George O.
Luddy, W. E.
Lynn, Samuel
Matthews, R. J.
Miller, John
Moir, W. B.
Myers, Arnold
McAbee, W. S.
McCune, J. C.
McHugh, C. A.
McGeorge, D. W.
McIntyre, R. C.
Osborne, William J.
O'Sullivan, J. J.
Painter, Joseph
Paisley, F. R.
Pehrson, Alfred K.
Ralston, J. A.
Renshaw, W. B.

Rogers, Robert
Schaacke, William
Searles, E. J.
Seiss, W. C.
Severn, A. B.
Shafer, John S.
Shannon, David E.
Shelly, D. L.
Showalter, Joseph
Simons, P.
Snyder, F. I.
Sparks, Hynes
Stark, F. H.
Stevens, R. R.
Strachan, M. B.
Stucki, A.
Stuebing, A. F.
Suckfield, G. A.
Tuttle, C. L.
Van Wormer, G. M.
Walther, G. C.
Webster, H. D.
Wheatley, William
Wikander, O. R.
Wilcox, H. C.
Wildin, G. W.
Woodward, Robert

VISITORS

Alexander, J. R.
Askin, J. A.
Bell, D.
Burgham, M. L.
Byron, Clyde
Campbell, Harry V.
Cannon, Tyrone M.
Carruthers, G. R.
Darrall, William G.
Daugherty, W. A.
Davis, William B.
Dexter, A. T.
Dickinson, T. R.
Dunham, C. W.
Eckels, W.
Egbert, J. A.
Endsley, Louis E., Jr.
Ensheimer, Louis
Fleming, P. M.
Graff, R. H.
Gray, R. H.
Gurley, L. R.
Hood, C. E.
Hoover, Edwin
Kalik, John
Kondej, H.
Kromroy, F. R.
Kleine, H. J.
Lewis, F. W.
Lewis, S. B.
Meyer, W. J.
Mohn, Louis
McCrea, F. G.
Norbom, E. B.
Oschman, William
Pearson, W. B.
Pyne, Frank
Reardon, John P.
Reed, M. R.
Riddile, H. C.
Sitterly, W. H.
Smith, C. W.
Smith, Sion B.
Stephensky, Jules
Zimmer, A. E.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with, as they have appeared in printed form and been distributed to the members.

The Secretary read the following list of applications for membership:

Burham, Maurice L., Sales Engineer, Edgewater Steel Company, 440 Freeport Street, Parnassus, Pa. Recommended by J. D. Conway.

Burkley, Frank H., Gang Foreman, Car Department, Union Railroad, Box 262, Unity, Pa. Recommended by J. T. Bowen.

Craig, John R., District Manager, Buckeye Chemical Company, 5621 Wellesley Avenue, E. E., Pittsburgh, Pa. Recommended by E. J. Garant.

Darrall, William G., Draftsman, Edgewater Steel Company, 347 James Street, Springdale, Pa. Recommended by O. R. Wikander.

Daugherty, W. A., Gang Foreman, Car Department, Union Railroad, Box 281, Universal, Pa. Recommended by J. T. Bowen.

Eckes, Joseph M., Salesman, Railway Products Company, First National Bank Building, Pittsburgh, Pa. Recommended by Samuel Lynn.

Elicker, Howard, Blacksmith, Union Railroad, Box 46, North Bessemer, Pa. Recommended by J. T. Bowen.

Garlow, Andrew, Air Brake Inspector, Union Railroad, North Bessemer, Pa. Recommended by J. T. Boden.

Harvat, Frank V., Air Brake Inspector, Union Railroad, R. D. 1, Box 95, Turtle Creek, Pa. Recommended by J. T. Bowen.

Johnston, A. L., Car Inspector, Union Railroad, Box 188, Unity, Pa. Recommended by J. T. Bowen.

Kalik, John R., Air Brake Inspector, Union Railroad, R. D. 1, Turtle Creek, Pa. Recommended by J. T. Bowen.

Keys, Arthur H., General Car Foreman, B. & O. R. R., 2801 Crosby Avenue, Pittsburgh, Pa. Recommended by H. C. Wilcox.

Kromroy, F. R., South American Representative, Westinghouse Air Brake Company, c/o G. C. Dehne, Wilmerding, Pa. Recommended by George W. Wildin.

Mauck, E. A., Air Brake Inspector, Union Railroad, Box 55, North Bessemer, Pa. Recommended by J. T. Bowen.

Meyer, Wendel J., Chief Engineer, O. C. Duryea Corporation, R. D. 7, Butler, Pa. Recommended by Samuel Lynn.

Misner, George W., c/o Westinghouse Air Brake Company, 301 Arlington Avenue, East McKeesport, Pa. Recommended by G. L. Cotter.

Mohn, Louis, District Manager, Garlock Packing Company, Frontenac Apartments, Highland Avenue, Pittsburgh, Pa. Recommended by Karl Berg.

Murray, Donald, President, Murray Safety Sling Company, Inc., 1015 South Avenue, Wilkinsburg, Pa. Recommended by L. V. Stevens.

Murray, James S., Manufacturing Agent, Goddard & Goddard, Inc., 392 Hazel Drive, Mt. Lebanon, Pa. Recommended by L. V. Stevens.

Murray, M. H., Salesman, United Oil Company, 906 Steuben Street, Pittsburgh, Pa. Recommended by L. V. Stevens.

Pacey, E. H., President, Pittsburgh Welding Corporation, 33 Water Street, Pittsburgh, Pa. Recommended by L. V. Stevens.

Stephensky, Jules, Air Brake Inspector, Union Railroad, R. D. 1, Turtle Creek, Pa. Recommended by J. T. Bowen.

Tarr, H. S., Foreman, Union Railroad, 413 Franklin Avenue, Wilkinsburg, Pa. Recommended by F. E. Gorby.

Thompson, Homer D., Air Brake Inspector, Union Railroad, Box 105, Unity, Pa. Recommended by J. T. Bowen.

PRESIDENT: These applications will be referred to the Executive Committee, in accordance with the rules, and upon approval by them the gentlemen named will become members without further action.

SECRETARY: Since our last meeting we have been advised of the death of one of our members. J. S. Turner died July 15, 1929.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the proceedings.

In accordance with our By-Laws it is necessary to appoint at this meeting a Nominating Committee to submit nominations for officers for the ensuing year. In observance of that requirement, I will appoint as the Nominating Committee:

Mr. F. H. Stark
Mr. W. C. Hansen
Mr. L. J. Kelly

and I will ask them to confer and be ready to report at a convenient time later in the evening.

If there is no further business, we come to the paper of the evening. You have all been made aware of the subject that is to be discussed and the speaker is no stranger to any of you. I will ask Professor Endsley to come forward, without further introduction, and present the paper.

SOME POINTS IN THE FREIGHT CAR DRAFT GEAR PROBLEM

By PROFESSOR LOUIS E. ENDSLEY,
Consulting Engineer, Pittsburgh, Pa.

This subject has been before the railroads for many years. The first railway cars did not have any draft gears but as cars and trains became larger and heavier the need of some resisting give between the cars was found necessary. First, a single coil spring was used and for cars that were in use forty years ago this spring did the work fairly well; but as the railroads came to the use of steel underframe and modern cars, the need of more capacity brought out the friction draft gear, for no longer could the capacity be obtained by a reasonable amount of springs. One real need of a friction draft gear is in the switching of the cars together. Another is the control of the slack in the train that is necessary to start the train. This slack, either controlled or uncontrolled, is necessary in order to start a train.. for on all our low-grade railroads most locomotives can take over the division all that it can start. No slack is necessary in order to stop any train or run it. This may be somewhat of a startling statement but anyone who has given it the thought which it deserves will bear me out in that statement. The only necessity for slack is in starting; in fact, it would be ideal, in my opinion, if some magic means could be devised to make a hundred-car train one long car after the train was in motion and thus maintain it until it was stopped. However, if the locomotive had to start such a train with no slack it would require a much larger locomotive for the modern train or a reduction of the train size for the present locomotive, so that slack for starting the train is necessary—but it should be draft gear travel and not free or uncontrolled slack. There is some free slack, such as coupler knuckle slack that in the present coupler is always there, but the slack around the key and yoke, shortening of the coupler shank, shortening of the draft gear, etc., should be kept to a minimum. It is from these that the excessive slack now in freight cars come. This extra slack that is not draft gear travel is causing much damage to freight cars and lading, and is also requiring extra work to be done by the draft gear. The brake shoes and the draft gear do the same thing, that is, stop the car, and the work required to stop a car from five miles per hour is the same, no matter what the means used, so far as work done is concerned. Of course, the brakeshoe—everyone appreciates—stops the train when the air is applied, but it takes the brakeshoes some 20 to 30 feet to stop a freight car from a speed at 5 miles per hour, and we expect two draft gears to do it in 2¾ inches travel of each gear. The car is switched into another car, or string of cars, and it is stopped by the work of the draft gears or damaged in some part of the car or lading. The draft gear also has to do some work that the brakeshoes are not required to do. The brakeshoes do not have anything to do with the starting of the train; however, the draft gear comes into use every time a train is started and it also is in use in equalizing the speed of cars in the train as the train is put over small raises in the tracks and goes into dips. At these times the coupler may be under tension, or it may be under compression, but at all times the draft gear, if working, is under compression and it is expected to equalize and cause uniform speed between two cars next to each other in the train, without damage or excessive pull or buff upon the couplers. Now, it is plain to anyone who gives it thought that any excess of free slack that may occur between the ends of two cars will materially increase the damage or work necessary for the draft gear to do when a train either goes into a depression or over a hump in the road, for in a hundred-car train, where this excess free slack is only one inch per coupler, and counting the coupler slack at ¾ inch per coupler, the run in and out would amount to over 55 feet in the length of the train. Now, if this could be reduced to a minimum, is it not obvious that the work required of the draft gear would be materially reduced?

The draft gear companies have designed a friction draft gear that will take care of a drop of the 9000# hammer of from 18″ to 28″ free fall of the hammer, with a draft gear travel of

2¾″, and this is about all they have been able to do with this travel. This means that the modern friction draft gear has a capacity of between 15,000 to 24,000 foot pounds. Now, in the modern freight car, where the A. R. A. "D" coupler is being used, it is safe to assume that any draft gear that closes at 400,000# or less will not damage any part of the coupler, or car, because the shank of the coupler will stand 400,000#, or a little more, without any set of the coupler shank, which is really the weakest point from a compression standpoint; so that if a draft gear could be designed to close at 400,000 pounds, there would be no danger of injuring any part of the car until after the draft gear had closed; but in order to have the draft gear close at 400,000 pounds, the initial pressure necessary to start the draft gear to close, in my opinion, would have to be approximately 300,000#, because I do not believe that you can, with angles, springs and friction surfaces, design a draft gear that will pick up more than 100,000# in a 2¾″ travel and be sure of releasing at all times. Now, if a draft gear is designed, as I stated above, with an initial pressure of 300,000#, it would be of no value in the starting of a train as it would be a solid block of metal; under this condition, however, it would give a capacity of almost 104″ of a fall of the 9000# hammer before it would close at 400,000#. Now, if we figure on a freight car draft gear that should have a capacity which will be available in the starting of the train, in my opinion the initial starting point should not be over 40,000 or 50,000 pounds. If the initial starting pressure is 40,000 pounds (and the slope is a straight line) the final pressure will only be approximately 150,000 pounds, with an average pressure of 95,000 pounds. For if a greater final pressure is obtained the draft gear may stick and not release because there is a limit to the slope of the pressure and travel line in the design of a friction draft gear in the present pocket and travel. Now, if a gear is made, as per this assumption, it will just close with the fall of the hammer of 28″ free fall and 2¾″ draft gear travel. This is near the limit at which the modern friction draft gear can act. It has been said that 100,000 pounds initial pressure can be used and a final pressure of 200,000 pounds; this would have almost the same slope line between pressure and travel. This gear would have a capacity of 46″ fall of the 9000 pound hammer. With a great many locomotives this 100,000 pound starting pressure would be equivalent to a solid block. If the draft gear has a capacity of approximately 30″ fall of the 9000 pound hammer which is the gear named above with 40,000 pound initial pressure, it will take care of a switching speed of approximately 5.0 miles an hour for the loaded 50-ton car and a little less than 4 miles an hour for the 70-ton car. Now, this may be a reasonable switching speed and is maintained in some yards. If the draft gear of this capacity is maintained in good repair this gear will handle all conditions of train operation that may arise in the 50-ton car train with the exception of a very few, without damage to the underframe of the freight car; providing the slack or free movement is kept at a minimum. There is, however, some doubt in my mind with regard to the 70-ton and larger car.

There is a way that the capacity of the draft gear can be increased materially and that is to increase the travel of the gear. As an illustration, let us assume that the draft gear travel is increased to 4⅛", which is just 50% more than the present draft gear, and the slope of the line of travel and pressure is maintained as in the assumed draft gear that had a starting pressure of 40,000 pounds and a closing pressure of 150,000 pounds with a 2¾-inch travel. In this assumed 4⅛" travel gear the initial pressure is taken as 40,000 pounds and the final pressure would be 200,000 pounds. Now this gear will have almost twice the capacity of the 2¾" gear, or a total fall of the 9000 pound hammer at the closing point of 55½".

There are some changes involved if the travel of the draft gear is increased; one is the air hose connection might have to be about one inch farther out and up; another, the shank of the coupler should be lengthened about three or four inches; also, a longer pocket for the draft gear in order that larger springs could be used. But these changes are not difficult and do not involve much expense or trouble. The saving in damage to our large cars and lading would more than pay for the cost. This extra travel is not as complicated as it seems; in fact, today there are many cars that have a travel of the coupler equal to or greater than the above mentioned travel; however, this is due to a considerable amount of slack which is not draft gear travel. So that if the draft gear travel were increased and the maintenance of the draft gear were carefully followed, there is no doubt in my mind but that the present hose and arrangement could be maintained; however, the increase in the length of coupler shank is made necessary by the limited space between the yoke and the striking casting.

The draft gear has, in some cases,—though not in many cases—had the attention it should have had. No repairs have been made to the draft gear in some cases until the coupler has pulled out or the sills have been bent or some major operation was necessary. Yet the railroads have for years watched very carefully the air brake and brakeshoe arrangement and felt that they saved many dollars by these systematic repairs. I am of the opinion that even a greater saving could be effected if the draft gear was watched as carefully and kept in repair with the minimum amount of slack.

As long as the present 2¾″ travel is maintained I believe the modern friction draft gear for freight cars should have not over 50,000 pounds initial starting pressure; also that the total fall of the 9000 pound hammer of 24″, or 2′, should not produce over 400,000 pounds pressure. This is equivalent to 18,000 foot pounds of work. Added to this will be the underframe capacity of about 4000 foot pounds. Also, I believe that the draft gear should stand about 600,000 pounds pressure without very much shortening. I selected the 600,000 pounds pressure because if that amount is produced in a static machine, or a few times in an impact machine, the coupler shank will shorten about one inch. Now, I do not believe it is necessary to put more metal in the draft gear than is necessary to produce the strength of the coupler shank, because it is a waste of metal if you do this and the occupying of very valuable space that could be better occupied by springs or wearing surfaces. I mentioned above the capacity of the underframe; I mean by this that if a freight car with 30 square inches of metal in the center sills was pressed at both ends by a force of 400,000 pounds the work necessary would be equivalent to a fall of the 9000 pound hammer of 5 inches. In other words, the give of the underframe up to a pressure of 400,000 pounds adds 5 inches to the capacity of all draft gears.

It is my opinion that we have two roads open to us; the draft gear should be designed to have a capacity that will be above that required for any switching speed that may be used; or, in case that is not possible, we should have something like a fuse block in an electric current that will blow out if it is overloaded.

In order to make this clear, let us assume that we have a box car that is loaded and the whole car and load weighs 150,000 pounds. Now a blow of two cars switching together of 300,000 pounds will do very little damage to either the car or the load, for the pressure between the cars per pound of weight will only be two pounds. Now, if an impact that is equal to 1,200,000 pounds should occur between these same two cars, each pound of car and load would have an eight-pound force upon it and damage to the car and lading would result if it is a box car with fragile merchandise in it. Now, if we could limit this force by some giving means to a maximum of 600,000 pounds, the pound force per pound of load and car would be four pounds. So that the ideal method would be to have a part in the draft gear arrangement that at a pressure of approximately 600,000 pounds would have a give that after one or more blows, depending upon their severity, would be destroyed and then replacing. The value of this so-called fuse block would depend upon how many food pounds of work that could be absorbed before the usefulness of it was all gone and had to be replaced. It is very easy to figure where such a fuse block could be inserted that would take a total set of ½ inch or more at a pressure of 600,000 pounds, and yet would not be affected at a load of 300,000 or 400,000 pounds. Just as an illustration of what could be done, assume that the coupler and draft gear casing was of the same strength and that when the draft gear was solid the distance from the head of the coupler to the back follower block would be 42 inches. Now, such an arrangement can be shown to stand one blow between two tank cars that are equipped with no dome and full of oil at a speed of eight miles per hour, with a maximum pressure of only 600,000 pounds if the draft gear has a capacity of 2 feet or 24 inches fall of the 9000 pound hammer. This same arrangement will stand ten blows at 5.6 miles per hour, 100 blows at 5.2 miles per hour, and 100,000 blows or more at 5 miles per hour before all the set of ½ inch would be produced in the 42 inches of metal between the back stop and the coupler head. Now, all these impact speeds here given will be greater in coal cars and box cars where the load can shift and other gives take place, but, in a tank car, as mentioned above, the load will not shift if the tank is full and has no dome.

In this connection I have felt for years that a good way to build tank cars would be to equip them with a dome on each end instead of one dome at the center, as now used in tank car construction. If this double dome tank car was switched, it would allow all the load to shift and would be equivalent to increasing the capacity of any draft gear that might be in the car. Now, it is easy to figure a dome on any modern tank car that will more than double the capacity of the draft gear! in other words, increase the switching speed 50% with the same force between the cars as now obtained.

Now, I have not put in many calculations and formulae that I could have burdened this paper with, but you engineers can figure out for yourselves—and I believe that the engineers here have—I have given you practical men this subject in common language and not too complicated. It has been the desire for years to get some simple means to determine the value of different draft gears in a testing laboratory. The rivet shearing test has been used; a Chronograph that draws a line on a revolving drum that requires tangents to be drawn to the curve in order to get the force during an impact; and the indentation of hard balls in steel has been used to determine the maximum force and closing point of gears. But all of these methods are somewhat complicated.

Some years ago, I conceived an instrument that would measure the pressure at any fall of the 9000 pound hammer upon a draft gear and three or four of these instruments have been placed upon different 9000 pound hammers. I personally have calibrated two of these instruments and have found that a reading can be obtained from the instrument which will give a very close approximation to within 3% to 5% of the maximum pressure coming upon any draft gear by reason of the fall of the 9000 pound hammer. The instrument is merely mounted on the hammer and when the hammer falls it is stopped by the pressure on the tup of the hammer, the steel rod going through this little instrument that is held securely by two heavy springs under compression with screwed caps upon the steel rod running over ball-bearing sleeves is also stopped but is not stopped as quickly as the hammer, due to the fact that the pressure must build up some before the center rod is stopped. By allowing this center rod to move only 1/5 as much as a pencil point, or stylus point, on the end of a bell crank with marks upon metallic paper, I was able to calibrate this instrument to within a 3% error. My method of calibrating was to take a cold rolled piece of steel as long as possible and machine it to blocks one inch long, the piece being one inch in diameter, and taking a block at the end and the center of the piece and calibrating the piece in a static testing machine for different amounts of set. It is a known fact that all pieces of the same pieces of cold rolled steel will show within 1% the same amount of set for any given load. Now, by taking these one inch blocks and placing them on the machine surface of a block resting upon a draft gear, and dropping the hammer until a shortening of each of the blocks of approximately .05 or .06 of an inch occurs at one impact, a reading of the movement of the pencil point checked almost identically with the reading of the static load as obtained in the static machine. For your information, this was carried out on two machines and the maximum error was less than 2% from the average line drawn through all tests made, which shows that the results are very close. Now, I do not say that the same pressure was necessary to produce set in a static machine as was necessary to produce the same shortening in an impact blow, but the results are directly comparable and a yard stick is obtained. This instrument will give me rather quickly what I think is required in the modern draft gear, viz., first, what pressure will a one inch fall of the 9000 pound hammer produce? This will be the starting or initial pressure of the draft gear. Second, what height of drop will just produce 400,000 pounds pressure? Third, what damage or shortening of the draft gear will be produced under a pressure of 600,000 pounds?

There are other things which must be found out about the draft gears, viz., How long will they maintain their initial capacity, or how long will they protect the car a reasonable amount? This life of a draft gear may be obtained in a drop hammer test but I am of the opinion that road condition is the only thing which will finally determine the life of the different draft gears. One of the things that is quite often brought up in the sale and purchase of draft gears is the question of guaranteeing them. Some railroads have asked for a guarantee of ten years. It is my opinion that a draft gear that will last ten years in modern car operation without repairs will be a very expensive gear, for something else besides the long-life gear is going to do the draft gear work. In other words, a solid block of metal would last for 30 years or more but would not protect the car very much.

Before I close I wish to say that the draft gear problem on our 70 ton cars will not be solved until the draft gear designer is given more travel, which means more space in which to put the draft gear. Also, after the car is put in service you railroad men must keep it in repairs and maintain at all times a minimum of slack. The only way that this can be done is by a well organized system of inspection and repairs.

PRESIDENT McABEE: You have heard an able address on a subject about which there is great diversity of opinion. Naturally, the speaker expects a little discussion. To start it I am going to call on our good friend and past President of this Club, Mr. George W. Wildin, because he is in the same line of work.

MR. GEORGE W. WILDIN: Mr. President, Members of the Railway Club of Pittsburgh and Visitors: It is not very often when called upon to make some remarks before the members of this Club that you observe me reading what I may have to say from typed copy. On this occasion I am somewhat in the position of a politician campaigning just before an election. I must record very carefully what I say to avoid misrepresentation through improper interpretation, and possibly later embarrassment by being called upon to deny things I did not say. Also, Mr. Official Stenographer, if everything is jumbled up in the printed proceedings when they are issued, you will not be called upon to share the honors with me.

Before I progress any further I want to compliment the author of this important paper for having the courage of his convictions to say what he thinks on the subject, right or wrong, in language we can all understand when discussing the subject of Friction Draft Gears.

I quote the following from the author's paper: "This subject has been before the railroads for many years. The first railway cars did not have any draft gears, but as cars and trains became larger and heavier the need of some resisting give between the cars was found necessary. First, a single coil spring was used and for cars that were in use forty years ago this spring did the work fairly well; but as the railroads came to the use of steel underframe and modern cars, the need of more capacity brought out the friction draft gear, for no longer could the capacity be obtained by a reasonable amount of springs." The founder of the company with which I am connected, Mr. George Westinghouse, bears the undisputed title of father of the Friction Draft Gear as applied to equipment on American Railways. He blazed the trail for the pioneers in this field. Mr. Westinghouse's first patent was issued just forty-one years ago and many of the points covered in this early patent can be recognized in several of the latest types of gears brought out in recent years by others. The underlying reason for bringing out the original friction draft gear was not, as stated by the author, because of steel underframe and modern cars. It will be seen that the development of friction draft gears preceded the advent of the modern steel and steel underframe cars anywhere from ten to twelve years, and even at that time the all steel and steel underframe cars were of comparatively light weight. The real reason which impelled Mr. Westinghouse to push the development of the Friction Draft Gear seems to have been overlooked, not understood or ignored by the author, as it has been by many draft gear engineers in the past. That reason was excessive recoil in the spring type gear, if of any material capacity, and the resultant effect recoil has on smooth, safe train operation. From the wording contained in the author's paper it could reasonably be assumed that if proper gear capacity could be had in the space provided by some suitable arrangement of springs, it would be entirely satisfactory to him. I question whether he really means this. After having experienced some severe train break-in-twos while demonstrating his air brake on English roads where the equipment is provided with heavy buffers of the spring type between the cars, Mr. Westinghouse summed up the situation in this terse comment. It is necessary that a brake be put on the Draft Gear as well as on the wheels, and we have as air brake people recognized that this feature in a draft gear cannot be ignored. The Draft Gear Committee recognized the force of this argument in their report of the Perdue tests and said, "A minimum recoil, consistent with freedom from sticking, is desirable." It goes without saying that a friction draft gear of any capacity can be constructed much more easily and avoid sticking by the introduction of high recoil than can be done with low recoil. It is not necessary, however, to introduce high recoil in a friction gear in order to prevent sticking if the gear is properly designed.

The author says, "One real need of a Friction Draft Gear is in the switching of the cars together." "Another is the control of the slack in the train that is necessary to start the train." The first statement is axiomatic and needs no amplification except to say that the more shock absorbing apparatus interposed the better, but the second reason will require some clarification. I presume he means that for the purpose of discussion we will consider theoretically that all the uncontrolled slack which he classifies in his paper is removed and that whatever flexibility is necessary to permit the starting of a train smoothly and without shock will be incorporated in the draft gear itself and this he proposes to do by increasing the gear travel materially. I agree with the idea that if all the uncontrolled slack in a train of cars could be eliminated in some way the millennium in train operation would be reached both from the air brake and draft gear standpoints, but this is only playful theorization. It will never be realized and it is with us to stay in some form or other so long as the general interchange of equipment is continued on our American Railways. The proper things to do then is to recognize this fact and advocate to the limit uncontrolled slack reduction, meet the situation as best we can before suggesting increased gear travel an appreciable amount which would only add to our difficulties.

Speaking of starting long trains from yards and hauling same over a division, I presume the author of this paper realizes that if all freight cars and locomotives were equipped with either ball or roller bearings, a modern locomotive could start a modern freight train from a terminal with all uncontrolled slack entirely removed, assisted only in its efforts by such flexibility as now exists in a well designed modern friction draft gear having 2½" or 2¾" travel. It would appear then that the "Magic Means" desired by the author is not so mythical but really in sight. As long, then, as we have started on an educational campaign, why not advocate letting every tub stand on its own bottom, allowing the draft gear to do its own legitimate work, but not burden it with work that does not belong to it, which can be taken care of in some other way. Some day this will be done, and many of us young men here tonight will live to see this arrangement the standard.

I agree heartily with the author as to the damaging effects of free slack and the added burden the draft gear is called upon to carry because of same as outlined by him on Page 2 of his paper, but I cannot with my knowledge of conditions encountered in interchange of cars between roads enthuse over the possibilities of getting the slack materially reduced and am, therefore, not in a position to share his sanquinity in this direction.

I think the author is somewhat in arrears as to what can be accomplished with the present limits allowed in the general gear dimension and 2¾ in. travel. There are gears produced today that will stand a free fall of the 9000 lb. tup of 34 in. to close and produce a sill pressure materially under the 400,000 lbs. he has suggested as a proper limit.

I agree with Mr. Endsley that the maximum sill pressure produced by any gear should range somewhere between 400,000 and 450,000 lbs. I do not agree with his statement that in order to have the draft gear close at 400,000 lbs. the initial pressure necessary to start the draft gear to close would have to be approximately 300,000 lbs., this because he does not believe that you can, with angles, springs and friction surfaces, design a draft gear that will pick up more than 100,000 lbs. in 2¾ in. travel and be sure of releasing at all times. The gear I just previously cited as being of 34″ free fall capacity with the 9000 lb. tup will yield under the static test at a load of 10,000 lbs., at ⅛ in. travel and will increase the load to 75,000 lbs. at ¾ in. travel. This will give us ¾ in. initial gear travel with a pressure ranging from 10,000 to 75,000 lbs. to help start the train which I think you will all agree provides a very flexible device and sufficient preliminary gear movement to enable a train to be started without difficulty. Under dynamic load the pressures will not reach the figures given for the static test. If 50,000 lbs. initial pressure as a maximum is permissible, consistent with proper flexibility as suggested by the author, then there is a considerable latitude left for the gear designer to increase the capacity of friction draft gears within the present prescribed limits of 2¾ in. travel.

The Westinghouse Air Brake Company has always followed the policy in improving the air brake from time to time, of making the new and improved parts work in harmony with the parts already in service and thus cover the transition period with as little annoyance as possible to the customer. The Westinghouse Friction Draft Gear Company has adopted the same policy, and we believe that every effort possible should be made to improve the draft gears in capacity and operating functions within the present prescribed limitations as set forth by the A. R. A. Coupler and Draft Gear Committee before any radical move is made.

Friction draft gears can be produced with fifty per cent greater capacity than the minimum prescribed by the A. R. A. Committee— all within the present limitations of 2¾ in. travel and a 24⅝″ pocket space, but about 99% of the gears being applied to cars at present are close to the minimum requirements simply because the Railways do not feel they can afford to pay a higher price for the better gear. Primarily, draft gears are applied to cars for protection purposes, both to car construction and lading and just why the Railways stop at about 60% of the protection now available is a puzzle to me. Some day they will realize their mistake and when they do the pendulum will swing the other way, and they will demand something beyond that which is possible to accomplish within the present limitations. When that time comes I have in mind an arrangement which we have worked out recently. This arrangement consists of applying two of the present standard gears in tandem. Both gears will come into action when buffing stresses are applied, and only one will come into action when pulling stresses are applied.

With this arrangement the sill stresses will be no greater at any one point than with the present single gear. The greater buffing capacity which is vital at all times is there where it should be and proper capacity and flexibility in starting and hauling trains is available. With this arrangement no alterations are necessary with either the location or length of the standard air brake hose. The coupler and shank will be maintained as present standard. No additional train slack will be added, due to increased gear travel. A standard gear can be used on both new and old cars, all of which is in the line of economy and facilitates interchange covering the transition period without the least difficulty. Any other arrangement means the same stiffness of gear in both pulling and buffing action which is not desirable above a certain point. Some additional length between the face of the buffing block and body bolster will be required and possibly a slight increase in sill spacing. These changes in car design are slight and permanent and do not present the numerous difficulties which would be encountered if the gear travel should be increased to 4⅛ in.

With the present limitations as to gear travel, sill spacing, pocket length, etc., a friction draft gear can be designed which will meet the following specifications:

Length of Gear.........	22⅜″
Width of Gear..........	12½″
Depth of Gear..........	9″
Travel of Gear.........	2¾″
Capacity of Gear.......	33″ free fall of the 9,000 lb. tup or 26,800 ft. lbs.
Recoil of Gear..........	8%
Absorption of Gear......	92%
Sill Pressure	450,000 lbs. maximum
Sturdiness	A. R. A. Specifications
Endurance	85,000,000 ft. lbs. average

I want to make myself clear as to the position the Westinghouse Friction Draft Gear Company takes on the subject of increased gear travel. We do not oppose increasing the gear travel a reasonable amount when present limitations are exhausted. In fact, we were among the first manufacturers to put out gears of long travel and it was only a few years ago that we reduced our large gears from a 3 in. to a 2¾ in. travel, purely to meet the limits adopted by the A. R. Association. We are aware that the simplest way to produce a smooth acting gear of increased capacity is to lengthen the travel, which increases the time element, a factor in absorption and the sill pressures will not be materially increased, but until the Railways see their way clear to make use of the maximum capacity gears now available under present limitations, the difficulties to be encountered in interchange incident to special sill pockets, longer hose connections, and coupler changes should be put off until that time actually arrives.

To sum up the situation as it appears to exist today it would seem that the present limitations placed on draft gear designers gives them sufficient latitude to enable them to produce a gear at least 50% greater in capacity than the railroads really desire at the present time and probably for some time to come. When the railroads change their views toward the draft gear situation and avail themselves of the maximum capacity gears available under the present limitations, draft gear manufacturers will be in a position to solve the draft gear problem for the Railways in the light of conditions which exist at that time. In the meantime, I think the draft gear manufacturers should confine their activities to improving their present devices in every way possible to meet the present and growing situation.

PRESIDENT McABEE: This being a draft gear discussion, I think we will for the present confine it to draft gear men. And I have in mind a draft gear man who comes to my office every once in a while and when he does he has me at a disadvantage because I have to say no to him right away. Mr. G. R. Farrell, of the National Malleable Company.

MR. G. R. FARRELL: I would like to be excused from entering into the discussion. I wish to say that I have enjoyed the paper very much.

PRESIDENT McABEE: We have with us the author of a paper at one of our preceding meetings. I am sure we would like a few words from him. Mr. Duryea.

MR. O. C. DURYEA: I did not come here prepared to speak on the subject. I have been very glad to be able to hear the paper.

PRESIDENT McABEE: We have a visitor with us, Mr. W. Eckels, of the Union Draft Gear Company. If he would care to make any remarks we would be very glad to hear from him.

MR. W. ECKELS: I noticed the remark of one of the speakers that we might have to come to tandem friction draft gears on modern cars. It may be of interest to know that such draft gears have been on several thousand cars and given good service for six to eight years. The only difficulty is that the railroads will not spend the money to apply such a draft gear.

With the additional travel that these gears have, the closing pressure is approximately the same as for a single gear applied in the so-called 24⅝″ standard pocket. These gears do almost double the work of a single gear, but do not cost twice the money.

I agree with Professor Endsley that longer travel will have to come. Many people do not agree with that, but considering the limitations we are allowed today, it is the only means by which we can consistently get higher capacity and increase the work done, which is the purpose of a draft gear.

PRESIDENT McABEE: We have another draft gear man with us, Mr. O. R. Wikander, of the Edgewater Steel Company. We would like to hear from him.

MR. O. R. WIKANDER: Mr. Chairman and Gentlemen: I do not think a discussion of the draft gear problem would be complete without mention of the report of the draft gear tests that were made during the past two years by the American Railway Association at Purdue University. These tests covered ten different makes of draft gears and ten draft gears of each make. This report is quite voluminous, but nevertheless it does not contain anything but the boiled down results of this investigation, and its contents are so instructive that any one who is interested in the draft gear problem at all ought to read the report in full.

It is particularly interesting to our city and to our Club because two of the competing draft gear manufacturers are located in Pittsburgh, and of the other manufacturers a great many are represented in the membership of this Club and at our meeting here tonight. It is also interesting to our Club in that our membership is represented on the A. R. A. Committee on Couplers and Draft Gears, which sponsors these tests, in the person of our distinguished past-President, Mr. Samuel Lynn.

In Professor Endsley's paper he states that the capacity of a draft gear corresponding to a total fall of 30″ drop of a 9,000 lb. tup is enough to take care of switching of 50,000 ton cars up to a speed of 5 miles per hour, which I think is correct. He also points out that for the 70 ton car the draft gear capacity is sufficient for a switching speed of a little below 4 miles per hour. On this basis a 70 ton car, assuming that it weights 200,000 lbs. as compared with a weight of 150,000 lbs. for the 50 ton car, would require a draft gear of increased capacity in the same proportion as the increase in weight. If the weight of the car increases from 150,000 lbs. to 200,000 lbs. the draft gear capacity ought to increase from 30″ to 40″ total fall. In the Purdue tests, recorded in the report I just spoke about, we find that the Ring Spring draft gear of the Edgewater Steel Company showed an average capacity of 27,000 foot pounds, which is equivalent to 36″ total fall of a 9,000 lb. tup, and only 10% less than the capacity of the 40″ total fall, which would be required for a 70 ton car in order to meet the requirements outlined by Professor Endsley. This 10% capacity would only affect the switching speed 5%. In other words there are draft gears available which will take care of the switching of a 70 ton car up to a speed of 4.75 miles per hour. Nevertheless, the Tentative Specification drawn by the above committee and published in their report only requires a minimum draft gear capacity of 18,000 foot pounds, which corresponds to a total fall of 9,000 tup of 24″. On the above basis this draft gear will take care of a 70 ton car at a switching speed of 3.88 miles per hour.

It may be that these modest requirements of the A. R. A. Coupler Committee are justified on the basis of the performance of the friction draft gears, which are in most common use today, but it would be a great incentive to the draft gear manufacturers if the railroads would formulate requirements which would meet more severe service conditions. In my humble opinion it is only a question of "ask and ye shall receive."

PRESIDENT McABEE: According to our cards we have only one more draft gear man here tonight, Mr. Steubing, of The Bradford Corporation of New York City. We would like to have a word from him.

MR. A. F. STUEBING: After hearing the carefully prepared remarks of some of the high dignitaries in the draft gear business, I arise with some dismay, totally unprepared. There is, however, one point I would like to bring out. In discussing draft gear capacity and draft gear performance we ordinarily base everything on the fall of the tup in the draft gear testing plant. I do not want to minimize the importance of draft gear testing plants because there are many character istics of draft gears that can be determined in no other way. At the same time I think we should keep in mind the difference between performance in a laboratory and performance in the car. To start with the bases in the laboratory tests are absolutely solid. The car always gives, and that immediately introduces a difference in the time factor which is important in the performance of a draft gear. Another difference is in the position of the gear, vertical in the laboratory test and horizontal in service, which may or may not be of importance, depending on the characteristics of the individual design. Furthermore, in actual service the draft gear closes by contact of couplers between two gears, and it has been shown that the closing of two gears occurs alternately, with considerable effect on the capacity.

Unfortunately the only tests which throw much light on the relative capacity in laboratory tests and in car impact are those made some ten years ago by the Railroad Administration. Comparing the capacity in the drop tests and in the double car impact test, which comes closest to duplicating the service conditions, we find that the ratio of capacity in car impact to capacity in drop tests varies from 70% to 140%. In other words, two gears might show precisely the same capacity in the drop test but in actual service the capacity of one might be twice as great as that of the other. That feature must be kept in mind in appraising the work of draft gears.

Furthermore, the condition of wear in actual service is quite different from the condition in the laboratory. Taking that into account in addition to the variation that has been shown in `these carefully controlled tests, I think we will all agree with the author of the paper that the final answer to the draft gear problem will be determined by results in service and not by results of laboratory tests.

PRESIDENT McABEE: We have heard from all the draft gear men we know are here tonight. We have heard from Mr. Wikander that all the railroad operating men have to do is to ask and it shall be given him. Now I think we should hear from one or two of the men who have to contend with the draft gear conditions on the large trains today. Mr. Flinn, of the Pennsylvania Railroad, what would you like to have in the way of draft gears?

MR. R. H. FLINN: I have been very much interested in the remarks that have been made about draft gears. Personally, I do not wish to pose as an expert or to criticise some of the statements that have been made, but I do want to say a word in defense of the railroads. They have been accused of being very backward in the matter of buying draft gears. In the last two or three months we have entered into a rather elaborate program of putting in heavy draft gears. We do seriously recognize the necessity of having a better draft gear than we have today. I do not say that there are not draft gears that will meet our present requirements, but we have got to get them on the cars, and all the railroads are faced with the same problem. We have increased in train length very materially in the past few years, and the necessity of starting these trains introduces very serious strains in the draft gear and the problem on which we are working all the time is to help get better train operation not only from the standpoint of safety, but reduction of operating expense. We recognize that it would be desirable to have heavy draft gears on the cars but that involves a very heavy expenditure. At present, we are putting in heavy draft gears on all cars getting general repairs, and hope to continue that as long as good business keeps the money rolling into the treasury. I thank you very much.

PRESIDENT McABEE: Mr. Lynn, may we hear from you?

MR. SAMUEL LYNN: Mr. Chairman and Gentlemen: Owing to the large number of mechanical engineers and representatives of various manufacturers being present I did not expect to be called on to say anything tonight. However, my good friend Mr. O. R. Wikander of the Edgewater Steel Company mentioned the fact that I am a member of the A. R. A. Draft Gear Committee, and also called your attention to the report of this Committee which was presented at the recent meeting of the American Railway Association—Mechanical Division—at Los Angeles in June.

Suffice it to say that the railroad executives of the country who are members of the American Railway Association felt the necessity of an improvement in our draft gears and, if I recall correctly, my good friend Prof. Endsley was a member of the Draft Gear Committee when the American Railway Association authorized a considerable sum of money to construct a building and purchase a draft gear testing machine, which equipment was provided and located at Perdue University where the tests on various types of draft gears could be conducted by persons not interested in any particular type or make of draft gear. A schedule of tests was decided upon, and the parties assigned to the work of making those tests accumulated the data which was compiled after considerable effort and presented to the A. R. A. Convention this year. This report has been carefully scrutinized by representatives of the different manufacturers of draft gears, as well as the mechanical men of the railroads. As I have already stated, there are a number of Mechanical Engineers present and, therefore, I am not going to get into any technical discussion of the paper.

However, I have followed Prof. Endsley's paper with considerable interest. He stated that in the early days of railroading cars were purchased and operated which did not have any draft gears or springs to absorb the shock when cars were coupled together. I cannot go back to the time when a spring or gear of some kind wasn't used in connection with the draw bar, however, I do remember when cars were equipped with one spring at each end, and as I have been following the car game since that period I have been more or less interested because of the fact that it was a part of my job to see that cars were repaired and in good running order. From the days of the single spring to the present time there has been a gradual, but marked, improvement in draft gears for freight car equipment. This was necessary because of the development of the freight car itself, due to the constantly increasing tonnage requiring both larger capacity cars and longer trains. However, the fact that the American Railway Association within the last few years authorized the expenditure of the large sum of money necessary to provide and thoroughly equip a draft gear testing plant demonstrates clearly that railroad men generally were of the opinion that we had not yet reached the last word in draft gears. As has already been intimated, I am still a member of the A. R. A. Coupler and Draft Gear Committee, and as a result of the tests which have recently been published and submitted to the Association instead of taking up your time tonight I would suggest that anyone present who desires further information on draft gears secure a copy of that report. However, I want to reiterate that the development of the draft gear has been a gradual and beneficial process, and I am sure there are a number of railroad men here tonight who can testify to the fact that the railroads are hauling heavier trains with much larger capacity cars with a small percentage of damage to either the equipment or to the contents of the car. Speaking for the Road with which I am connected, we are hauling trains every day containing from 90 to 115 cars. Some of these trains are of mixed equipment, consisting of 70-ton hoppers, mill type gondolas, box cars, flat cars, etc., and I am informed by our freight claim department that our loss caused by damage is considerably small, however, there is a considerable loss due to this cause when the railroads of the country as a whole are taken into consideration, and because of this loss in freight claims, as well as damage to equipment, the railroad executives are still endeavoring to get a draft gear which will improve our present conditions. Our A. R. A. Committee, with the co-operation of the draft gear manufacturers, is endeavoring to develop a still better draft gear, and it is to be hoped that we can find, through this co-operation, a draft gear which will better meet present-day requirements. Personally, I do not expect to see this problem solved immediately. We must remember that for years the draft gear manufacturers have employed the best engineering talent available in order to have gears adequate for present-day requirements, and I believe that with the support of the American Railway Association, and the closer co-operation of the manufacturers with the Draft Gear Committee, they, together, will be able to solve this problem, and draft gears will be produced that will still further reduce the loss caused by damage to equipment and damage to shipments in transit.

PRESIDENT McABEE: Before we bring this interesting and important discussion to a close, is there any one who would like to ask the author of the paper any questions?

MR. D. F. CRAWFORD: As there do not seem to be any questions. Therefore I would like to move that the Club give a vote of thanks to Professor Endsley for his very interesting and very instructive paper.

The vote of thanks was carried by unanimous rising vote.

PRESIDENT McABEE: Is the Nominating Committee ready to make a report?

MR. F. H. STARK: Mr. President and Gentlemen: Your Committee after spending some little time in considering the subject, beg leave to report the following nominations:

FOR PRESIDENT:
E. W. Smith, Vice-President, Pennsylvania Railroad.

FIRST VICE-PRESIDENT:
Professor Louis E. Endsley, Consulting Engineer.

SECOND VICE-PRESIDENT:
J. E. Hughes, Superintendent, P. & L. E. R. R.

TREASURER:
E. J. Searles.

SECRETARY:
J. D. Conway.

EXECUTIVE COMMITTEE (Eight to Elect):
Frank J. Lanahan, Chairman,
A. Stucki,
Samuel Lynn,
D. F. Crawford,
F. G. Minnick,
G. W. Wildin,
E. J. Devans,
W. S. McAbee.

SUBJECT COMMITTEE (One to Elect):
S. G. Down, (To serve 3 years).

ENTERTAINMENT COMMITTEE (One to Elect):
Robert Rogers, (To serve 3 years).

MEMBERSHIP COMMITTEE (Four to Elect):
William H. Boyce, (To serve 3 years),
E. Emery, ”
R. M. Long, ”
Donald O. Moore, ”

RECEPTION COMMITTEE (Two to Elect):

R. H. Flinn, (To serve 3 years)
Col. H. C. Nutt, ”

FINANCE COMMITTEE (One to Elect):

Lloyd Sutherland, (To serve 3 years).

F. H. STARK,
WILLIAM C. HANSEN,
L. J. KELLY,
Nominating Committee.

(NOTE)—Members whose terms have not expired are not shown in above list of nominations and will not appear on the ballots, but will continue to serve for balance of term and on committees as elected.

PRESIDENT McABEE: You will understand, gentlemen, that the nominations submitted are the recommendations of the Committee. You will receive a regular ballot in your next letter from the Secretary, and you are also at liberty to substitute any name you wish for any office that is to be filled at that time.

The next regular meeting will be on the 24th of October and will be the Annual Meeting. We hope you will all be present and will bring with you any friends whom you think would be interested in the Club.

There being no further business.

On motion, adjourned at 10 o'clock P. M.

J. D. CONWAY, Secretary

In Memoriam

J. S. TURNER
Died July 15, 1929

INDEX OF
PAPERS AND THEIR AUTHORS
Presented Before Railway Clubs During the Season of 1928-1929

Compiled by the Society of Railway Club Secretaries

THE RAILWAY CLUB OF PITTSBURGH

John D. Conway, 1841 Oliver Bldg., Pittsburgh, Pa.
Secretary

September, 1928—"Safety Problems in Coal Mining." By *Mr. H. P. Greenwald, Supervising Engineer, Experimental Mine Section, United States Department of Commerce, Pittsburgh, Pa.*

October, 1928—"Annual Meeting and Smoker."

November, 1928—"The Manufacture of Seamless Steel Tubes." By *Mr. H. E. Passmore, Jr., National Tube Company, Pittsburgh, Pa.*

December, 1928—"Benefits and Economies of Automatic Connectors." By *Mr. C. O. Bradshaw, Vice-President, Robinson Connector Company, New York, N. Y.*

January, 1929—"Science in Industry." By *Dr. E. R. Weidlein, Director of Mellon Institute of Industrial Research, Pittsburgh, Pa.*

February, 1929—"Aviation as it Affects the Railroads." By *Mr. S. E. McMaster, Supervising Agent, Pennsylvania Railroad, Captain,Corps of Engineers, U. S. Army Reserve, Altoona, Pa.*

March, 1929—"Comparison of Policies of Consolidation of Railroads in Great Britain and America." By *Howard C. Kidd, Ph.D, Propessor of Commerce, University of Pittsburgh,, Pittsburgh, Pa.*

April, 1929—"The Duryea Underframe for Railroad Cars" By *Mr. O. C. Duryea, President, O. C. Duryea Corp., New York, N. Y.*

May, 1929—"Utilization of Locomotives." By*Mr. J. M. Nicholson, Fuel Conservation Engineer, The Atchison, Topeka & Santa Fe Railway System, Topeka, Kans.*

NEW YORK RAILROAD CLUB

Room 904, 26 Cortlandt St., New York, N. Y.

September, 1928—"Caprotti Valve Gear as Applied to Locomotive Engines." By *Mr. W. A. Austin, Consulting Engineer, Baldwin Locomotive Works, Philadelphia, Pa.*

October, 1928—"General Electric Company Night." By *Mr. C. B. Keyes, Dist. Manager Railway Dept., and Mr. L. T. Carter, Engineer. Dept., General Electric Company, New York, N. Y.*

November, 1928—"Motor Transport Night." By *Mr. R. J. Littlefield, Manager, Boston & Maine Transportation Company, Boston, Mass. Mr. F. S. Hobbs, Manager of the New England Transportation Company, a subsidiary of the N. Y. N. H. & H. R. R., and Mr. E. D. Osterhout, Passenger Traffic Manager of the Reading Transportation Company.*

December, 1928—No Meeting. Annual Christmas Dinner.
Address By *Mr. C. M. Keys, President, Transcontinental Air Transport, Inc., and Associated Interests,* "Air and Rail Transportation."
Address by *Mr. Elisha Lee, Vice-President, Penna. R. R.,* "Why Does Man Wish to Fly?"
Address By *Lieut. Commander Charles E. Rosendahl of the United States Navy.* "Flights of the Graf Zeppelin."
Address By *Mr. Charles C. Paulding, Vice-President, N. Y. C. Lines,* "Three Means of Transportation."

January, 1929—"Oxygen The Wonder Worker." By *Mr. A. G. Harcke, Publicity Engineer, Air Reduction Sales Company.*

February, 1929—"Transportation by Railroad is the Stone of Modern Civilization and Prosperity." By *Mr. A. G. Pack, Chief Inspector, Bureau of Locomotive Inspection, I. C. C., Washington, D. C.*

March, 1929—"Application of Compressed Air to Track Construction and Maintenance." By *Mr. W. H. Armstrong, Manager Tie Tamper Sales, Ingersoll-Rand Company.*

April, 1929—"Budgeting the Pennsylvania Railroad." By *Mr. A. J. County, Vice-President, Penn. R. R., Philadelphia, Pa.*

May, 1929—"New Haven Night." By *Mr. J. J. Pelley, President, and Mr. J. A. Droege, General Manager, N. Y. N. H. & H. R. R., also Mr. W. F. Garcelon, General Chairman, New England Shippers' Advisory Board, and Prof. Kent T. Healy, Asst. Professor Transportation, Yale University.*

CENTRAL RAILWAY CLUB OF BUFFALO

T. J. O'Donnell, 1004 Prudential Bldg., Buffalo, N. Y.
Secretary

September, 1928—Motion pictures: "A Trip Around The World," presented by the Canadian Pacific Railway. Ladies Night.

October, 1928—"Locomotive Terminal Operation." By *A. G. Hentz, Master Mechanic, New York Central Railroad, East Buffalo, N. Y.*

November, 1928—"Romance of Transportation." By *W. R. Cox, Freight Traffic Manager, Penn. R. R., Pittsburgh, Pa.*

December, 1928—"Making the Public a Friend of the Railroads." By *C. M. Knowles, General Agent, Pass. Dept., Erie R. R., Buffalo, N. Y.* "Grain Car Loading." By *E. M. Hull, Grain Outturn Dept., Metropolitan Casualty Insurance Company, New York, N. Y.*

January, 1929—Annual Meeting and Dinner. Addresses By *Rev. John C. Carr, of Buffalo; Samuel O. Dunn, Editor "Railway Age," Chicago, Ill.; Rev. G. A. Leichliter of Buffalo, Pastor of the Prospect Avenue Baptist Church.*

February, 1929—"An Aid to Transportation." By *W. H. Sanford, Asst. Vice-President, American Car & Foundry Company, Buffalo, N. Y*

March, 1929—"General Electric Company Night." By *R. N. Darrin, Representative.*

April, 1929—"Traffic Night." By *H. G. Taylor, Manager Public Relations, American Railway Association, Car Service Division, Washington, D. C., and R. J. Menzies, Asst. Traffic Manager, N. Y. C. R. R., New York, N. Y.*

May, 1929—"Locomotive Design for Switching and Yard Service with Limited Cut-Off and Booster." By *Harry S. Vincent, Chief Consulting Engineer, the Franklin Railway Supply Co., Inc., New York, N. Y.*

WESTERN RAILWAY CLUB

W. J. Dickinson, 189 W. Madison St., Chicago, Ill.
Secretary

September, 1928—"Where Are the Railroads Headed?" By *Samuel O. Dunn, Editor, "Railway Age."*

October, 1928—"Automatic Train Control." By *Mr. J. A. Peabody, Signal Engineer, Chicago & Northwestern Ry.*

November, 1928—"Caprotti Valve Gear as Applied to Locomotive Engines." By *W. A. Austin, Consulting Engineer, Baldwin Locomotive Works.*

December, 1928—Ladies Night.

January, 1929—Chicago World's Fair Centennial Celebration.
"American Car & Foundry Company Night."
Moving Picture: "In the Service of Transportation."

February, 1929—"Adequacy & Efficiency of Railway Equipment." By *Mr.*

M. J. Gormley, Chairman Car Service Division, American Railway Association.

March, 1929—"Rail Motors." A treatise on the design, construction, operation and maintenance of motorized rail equipment. By *Mr. E. Wanamaker, Electrical Engineer, Chicago, Rock Island & Pacific Ry.*

April, 1929—"Santa Fe Railway Power Plant Test Car." By *Mr. E. E. Chapman, Engineer of Tests, Atchison, Topeka & Santa Fe Ry.*

May, 1929—Annual Dinner.

NEW ENGLAND RAILROAD CLUB

Wm. E. Cade, Jr., 683 Atlantic Avenue, Boston, Mass.
Secretary

October, 1928—"Transportation and Potatoes." By *W. K. Hallett, General Manager, Bangor & Aroostook R. R.*

November, 1928—"The Marine Activities of the Canadian Pacific." By *H. B. Beaumont, Steamship General Passenger Agent, Canadian Pacific Railway.*

December, 1928—"Budget or Allotment of Railroad Purchases." By *D. C. Curtis, Chief Purchasing Officer, Chicago, Milwaukee, St. Paul and Pacific Railroad.*

January, 1929—"Some Aspects of Modern Packing and Container Practices." By *Edward Dahill, Chief Engineer, Freight Container Bureau, American Railway Association.*

February, 1929—"Progress in Track and Roadbed Construction and Maintenance." By *J. V. Neubert, Chief Engineer, Maintenance of Way, the New York Central Railroad.*

March, 1929—Forty-sixth Annual Meeting, Election of Officers and Reports. Also an address, with moving pictures on the Oxy-acetylene Process By *G. E. Harcke, Oxy-acetylene Engineer of the Air Reduction Sales Company.*

April, 1929—"Super-Power versus Reassigned Locomotives for Secondary Service." By *W. E. Woodard, Vice-President, Lima Locomotive Works, Inc.*

May, 1929—Annual Entertainment.

ST. LOUIS RAILWAY CLUB

B. W. Frauenthal, Drawer 24, M. P. O., St. Louis, Mo.
Secretary-Treasurer

May, 1928—"A Subway Electric Terminal Plan for St. Louis." By *D. W. Snyder, Jr., Vice-President, Illinois Traction Co*

June,, 1928—"Public Relations between Railroads and Shippers." By *Operating Committee, American Association of Railroad Superintendents.*

July, 1928—"Best Method of Promoting Safety, Employes' Relations." By *Operating Committee No. 7, American Association of Railroad Superintendents.*

August, 1928—Index of Papers and their Authors, all Railway Club Season 1927-1928.

September, 1928—"Utility of Radio in Train Operation." By *J. P. Barton, Radio Engineer, Westinghouse Electric & Manufacturing Co., Chicopee Falls, Mass.*

October, 1928—"World's Civilization Influenced by American Progress." By *Honorable Pat M. Neff, Member United States Board of Mediation.*

"The Progress of Block Signaling on the Missouri Pacific Railroad." By *Paul M. Gault, Signal Engineer.*

November, 1928—"Faith, the Source of Success in Railroading." By *A. D. Aiken, Asst. Gen'l Freight Agent, Chicago, Rock Island & Pacific Railway.*

December, 1928—"The Pullman Surcharge." A memorandum.

January, 1929—"Postal Service." By *Athol J. Michener, Postmaster, City of St. Louis.*

February, 1929—"Railway Transportation and Traffic." By *George W. Stephens, Professor of Transportation, Department of Economics, Washington University, St. Louis.*

March, 1929—"Industrial Expansion of St. Louis." By *George C. Smith, Director Industrial Bureau of the Industrial Club of St. Louis.*

April, 1929—"The Modern Trend of Railroad Regulation." By *Kenneth F. Burgess, General Solicitor, Chicago, Burlington & Quincy Railroad, Chicago, Ill.*

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB

A. T. Miller, 4 Hunter St., S. E., Atlanta, Ga.
Secretary

September, 1928—"Stores Accounting." By *O. L. Browne, Asst. to Pur. Agt., A. C. L., Wilmington, N. C.*

November, 1928—"Conditions in India." By *Mr. George V. Martin, National Malleable & Steel Castings Co., Washington, D. C.*

January, 1929—"The Story of Leather." By *Compton W. Nohl, E. F. Houghton & Co., St. Louis, Mo.*
"Centralized Traffic Control Dispatching System." By *Mr. W. D. Cloud, General Railway Signal Co., New York, N. Y.*

March, 1929—"Caprotti Valve Gear." By *Mr. W. A. Austin, Baldwin Locomotive Works, Philadelphia, Pa.*
"The Automotive Worm Gear." By *Mr. Geo. E. Watts, Timkin Detroit Axle Co., Atlanta, Ga.*

May, 1929—"History and Development of the Iron Industry." By *Mr. W. W. Shackford, Blacksmith Foreman, A. C. L., Waycross, Ga.*
"Vapor Purification." By *Mr. R. W. Andrews of Blaw-Knox Co., Pittsburgh, Pa.*

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CANADIAN RAILWAY CLUB, INC.

Charles R. Crook, 129 Charron St., Montreal, Quebec
Secretary

September, 1928—"Construction of Welland Ship Canal." By *Mr. A. W. Butler, Asst. Engineer in charge, Welland, Ont.*

October, 1928—"Missionary of Civilization." By*Mr. W. A. Austin, Baldwin Locomotive Wks., New York.*

November, 1928—"The Use of Pulverized Fuel for Generating Steam." By *Mr. D. J. Irish, Research Engineer, Foster Wheeler Corp., New York.*

December, 1928—"Employee Education." (Competition Paper) By *Mr. J. G. Heisler, Statistical Dept., Canadian Pacific Railway, Montreal.*

January, 1929—"The Relationship of the Railroads to Steamship Transportation." By *Mr. A. A. Gardiner, General Passenger Agent, Canadian National Railways, Montreal.*

February, 1929—"The Recent Developments in the Testing and Application of Bearing Bronzes." By *Mr. H. J. French, Senior Metallurgist, Bureau of Standards, Washington, D. C.*

March, 1929—"Transportation." By *Mr. D. Crombie, Chief of Transportation, Canadian National Railways, Montreal.*

April, 1929—"Transportation Problems in a Modern City." By *Mr. Paul Seurot, Engineer of Rapid Transit, Montreal Tramways, Ltd., Montreal.*

May, 1929—Annual Meeting and Election of Officers.

CLEVELAND RAILWAY CLUB

F. L. Frericks, 14416 Alder Avenue, Cleveland, Ohio
Secretary

October, 1928—Discussion of A. R. A. Supplement No. 1, to the 1928 Mechanical Rules.

November, 1928—"Temperature Study of Car Journals in Motion." By *Mr. W. H. Davis, General Service Manager, Universal Packing & Service Co., Chicago, Ill.*

December, 1928—"The Design, Application and Operation of Railway Roller Bearings." By *Mr. Walter C. Sanders, General Manager, Railway Division, The Timken Roller Bearing Co., Canton, Ohio.*

January, 1929—Annual Meeting—No topic.

February, 1929—Discussion of Changes in the 1929 Mechanical Rules.

March, 1929—Discussion of Changes in the 1929 Mechanical Rules.

April, 1929—"Why We Must Teach Safety to Sensible Men." By *Mr. W. W. Wood, Supt. of Safety and Welfare, Baltimore & Ohio R. R., Baltimore, Md.*

May, 1929—"Rough Handling of Cars." By *Mr. C. M. Williams, Supt. New York Central Railroad, Cleveland, Ohio.*

June, 1929—"Placing Enthusiasm in Your Work." By *Mr. W. F. Johnson, Supervising Safety Agent, New York Central Railroad, Cleveland, Ohio.*

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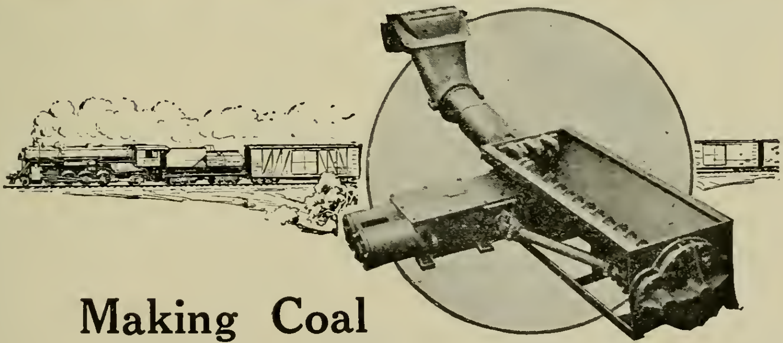

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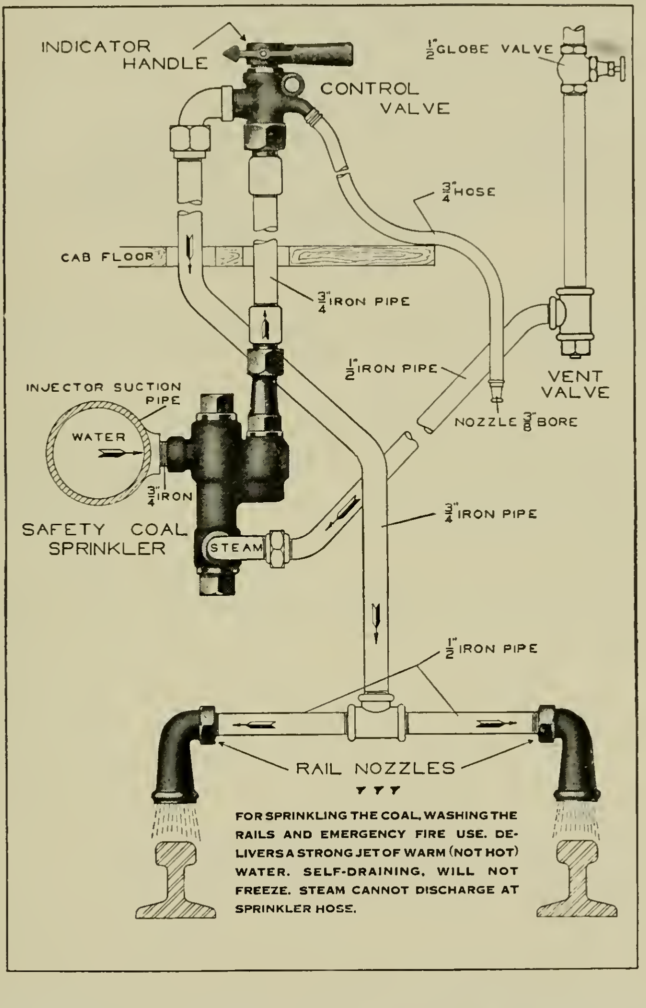

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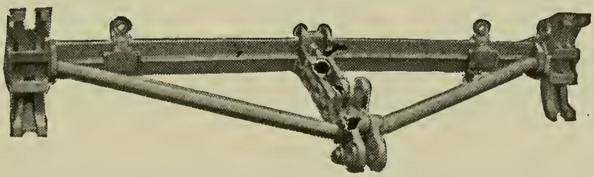

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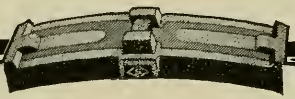

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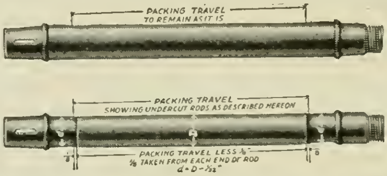
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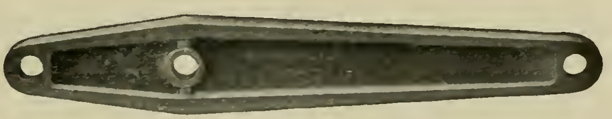

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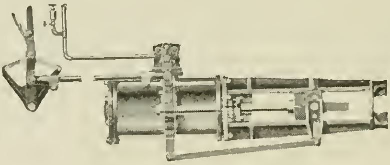

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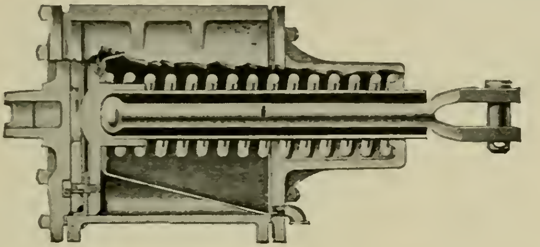

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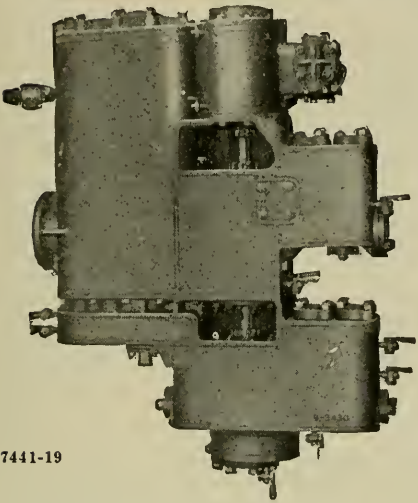

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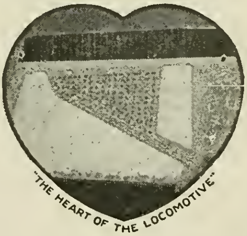

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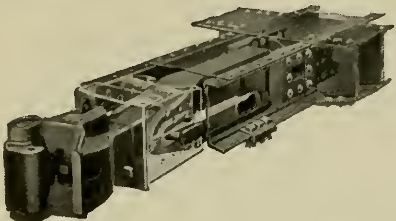

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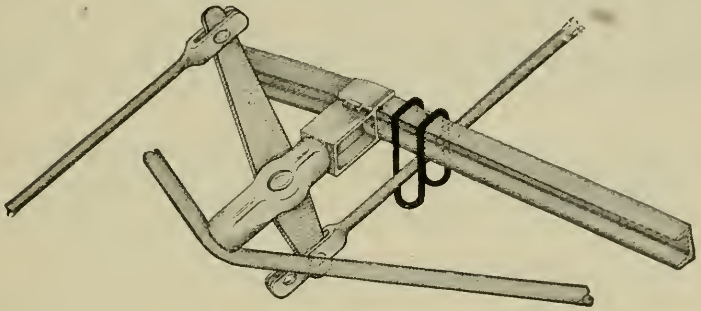

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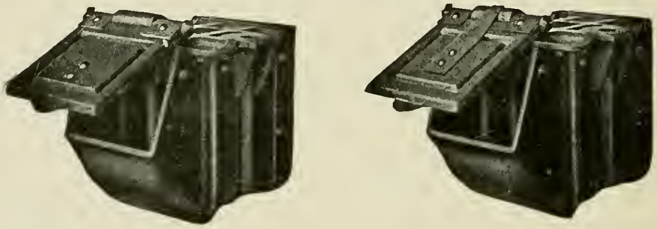

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No. 9.

Pittsburgh, Pa., Oct. 24, 1929.

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*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
OCTOBER 24, 1929

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Brinkhoff, W. H.
Brown, C. C.
Brown, C. L.
Burel, W. C.
Byrom, W. Reed
Callahan, F. J.
Campbell, J. E.
Campbell, J. T.
Cannon, T. E.
Canterbury, L. E.
Carlson, L. E.
Carr, T. W.
Carson, John
Christy, F. X.
Cipro, Thomas
Clements, Frank C.
Coleman, J. D.
Conlon, Jonh F.
Conway, J. D.
Cooper, Sidney B.
Copeland, T. A.
Corcoran, James
Cotter, G. L.
Coulter, A. F.
Courtney, H.
Craig, John R.
Crawford, D. F.
Crenner, J. A.
Crispen, Raymond B.
Croke, Thomas F.
Cunningham, R. I.
Cunningham, W. P.
Dalzell, W. E.
Dambach, C. O.
Darrall, William G.
Daugherty, W. A.
Davern, T. C.
Davis, Charles S.
Dehne, George C.
Dempsey, P. W.
Descamp, J.
Diven, J. B.
Doyle, William E.
Durkin, James E.
Eagan, Daniel F.
Edwards, C. H.
Eichhorn, T. F.
Emerick, J. B.
Emery, C. W.

Emery, E.
En Dean, J. T.
Endsley, Prof. Louis E.
Evans, David F.
Fagan, R.
Falkner, A. J.
Farrington, R. J.
Fleckenstein, August
Fieldson, P. H.
Fink, P. J.
Fischer, George E.
Fisher, G. Malcolm
Fisher, J. J.
Fletcher, Albert
Flinn, R. H.
Francis, G. E.
Freshwater, F. H.
Fritz, A. A.
Fults, J. H.
Funfer, James
Gardner, K. C.
Gilg, Henry F.
Glenn, J. H.
Glessner, G. P.
Goda, P. H.
Goff, J. P.
Goodman, O. F.
Gordon, George A.
Hale, Otis R.
Haller, Jacob
Haller, Nelson M.
Hansen, W. C.
Harper, G. C.
Harvat, Frank V.
Hasting, Walster S.
Haskell, B.
Herlehy, David T.
Herrick, A. S.
Herrold, A. E.
Hershey, Q. W.
Hickling, F. G.
Hill, W. D.
Hilstrom, A. V.
Hollingsworth, C. N.
Holmes, E. H.
Honsberger, G. W.
Hood, J. M.
Hoover, J. W.
Hughes, John E.
Hykes, W. H.
Jenkner, Oscar
Johnston, George E.
Kalik, John R.
Kavanagh, D.
Kelin, H. S.
Kelly, J. P.
Kempton, J. W.
Kerr, Clark R.
Ketterer, F. P.
Kiefer, Fred
Kirkpatrick, R. L.
Kroske, J. F.
Kummer, Joseph H.
Lanahan, Frank J.
Lanahan, J. S.
Lang, W. C.
Laughner, C. L.
Leonard, C. W.
Linsenbigler, Allen J.
Lobez, P. L.
Long, R. M.
Luddy, W. E.
Lynn, William
Maliphant, C. W.
Manson, A. J.
Merscher, John
Millar, C. W.
Miller, George
Miller John
Mills, C. C.
Mitchell, F. K.
Mitchell, J. G.
Mitchell, W. S.
Misner, George W.
Mohn, Louis
Moir, W. B.
Mogan, John M.
Montgomery, J. L.
Moody, W. R.
Moore, Donald O.
Moses, G. L.
Moxey, A. C.
Moyer, Oscar G.
Muir, R. Y.
Mycoff, George H.
Myers, Arnold
Myers, R. C.
Myers, W. H.
McAbee, W. S.
McDonald, J. T.
McGinnis, Thomas P.
McIntyre, R. C.

McMillan, A. P.
McNamee, W. W.
Nagel, James
Nieman, Harry L.
Noble, Jesse A.
Nutt, Col. H. C.
O'Connor, M. J.
Orr, D. K.
Osborne, William J.
O'Sullivan, J. J.
O'Toole, Thomas J.
Pacy, E. H.
Painter, C. L.
Paisley, F. R.
Palmer, E. A.
Paul, Lesley C.
Perkins, Charles F.
Peterson, W. M.
Pillar, Michael
Posteraro, S. F.
Prince, James Albert
Pringle, J. L.
Provost, Sam W.
Rabold, W. E.
Ralston, J. A.
Rauschart, E. A.
Read, A. A.
Record, J. F.
Redding, J. H.
Rogers, Robert
Roth, Philip J.
Rushneck, G. L.
Saltic, Thomas
Sattley, E. C.
Schneider, George
Schmitt, Raymond F.
Searles, E. J.
Seibert, W. L.
Seiss, W. C.
Semethy, J.
Seroky, Edward A.
Shafer, John S.
Sharp, H. W.
Shellenbarger, H. M.
Shelly, D. L.
Sheridan, T. F.
Showalter, Joseph
Smith, E. W.
Smith, J. Frank
Smith, R. W.
Snyder, F. I.
Snyder, H. C.
Stebler, W. J.
Stephensky, Jules
Stevens, R.R.
Stevenson, Richard
Stine, D. H.
Stoffregen, Louis E.
Stritzinger, Frank R.
Stucki, A.
Sutherland, Lloyd
Sykes, A. H.
Teckemeyer, J. Fred
Trowbridge, F. A.
Van Vranken, S. E.
Van Wormer, G. M.
Warfel, J. A.
Warner, Russell H.
Warrensford, Fred S.
Welch, E. M.
Whalen, D. J.
Wheatley, William
White, A. B.
Wildin, G. W.
Winslow, Sidney H.
Wright, John B.
Wright, O. L.
Wyke, J. H.
Young, F. C.
Zammikiel, John

VISITORS

Aiton, John C.
Alexander, Samuel
Allison, F. T.
Anderson, F. W.
Anderson, R.
Askin, J. A.
Atkins, H. E.
Bell, D. H.
Berner, John
Bishop, M. L.
Blumling, Fred J.
Blumling, Harold J.
Bollinger, W. A.
Boot, W. P.
Bott, William J.
Boyle, Kyran J.
Braithwaite, George L.
Brett, F. E.

Brown, Homer
Brown, R. J.
Burgess, T. S.
Burgess, W. C.
Burriss, H. E.
Burriss, Walter C.
Butler, Ray
Cacowe, M. S.
Cameron, S.
Campbell, Harry V.
Carmalt, J. L.
Carruthers, G. R.
Caufield, L. T.
Christy, George J.
Clebansky, J. C.
Cobbett, Albert J.
Colchaser, L. A.
Comers, Andrew G.
Comers, Walter
Conway, Scott M.
Cornelius, P. R.
Courtney, Edward A.
Craig, James A.
Crux, Clarence A.
Cunningham, H. L.
Currlin, W. E.
Davis, John W.
Davis, William B.
Dickinson, T. R.
Dickson, K. B.
Diegelmann, Clarence
Diettrich, E. J.
Diettrich, J. J.
Dietz, Frank, Jr.
Dignam, James
Donovan, J.
Dow, F. W.
Duffy, D.
Dugan, Harry
Duncan, Robert G.
Durkin, T. L.
Easter, E. H.
Evans, C. V.
Evans, E. T.
Farrell, I. W.
Farrington, Arthur R.
Fauth, Joseph F.
Fice, Herbert
Fisher, William R.
Flinner, J. D.
Ford, E.
Fox, George W.
Freeman, E. H.
Frey, A. R.
Freyermuth, L. C.
Funfer, V.
Gamble, E. B.
Garner, J. H.
Garner, R. K.
Garrity, Thomas M.
Gill, A. H.
Gillen, J. B.
Gilmore, Glenn T.
Gimbel, George
Ginter, Howard
Gliaquinla, Sam
Goodman, W. J.
Gordon, William J.
Green, George J.
Grice, C. E.
Grimm, W. R.
Grocott, P. W.
Groves, David
Guard, Thomas
Haas, Fred
Hall, Charles B.
Hall, J. M.
Hamilton, J. S.
Harbourt, C. W.
Hare, L. S.
Harger, M. F.
Harper, John T.
Hart, A.
Harvat, Henry
Harvat, Joseph
Haubrick, Lawrence G.
Haupt, H. H.
Herbst, F. A.
Hewlett, L. R.
Hildwhand, L. B.
Hockenberry, H. D.
Hollis, H. E.
Huchel, H. G.
Hughes, Reese
Hunter, J. M.
Hurray, C. A.
Hyde, A. C.
Janis, G. L.
Jaros, W. O.
Johnson, George R.
Jones, Percy
Jones, William J.

Joyce, S.
Kachock, Joseph
Kalik, Joseph
Kennedy, W. R.
Klann, P. B.
Klue, H. F.
Knapp, Ray F.
Knight, W. R.
Kyle, T. C.
Lauric, Frank
Lauth, Fred
Laylen, M. H.
Leahy, M. F.
Leavers, E. J.
Lee, Augustine L.
Leich, George
Lewis, H. L.
Lewis, S. B.
Lind, John A.
Lowman, John R.
Ludington, W. H.
Lynch, Byron
Lyons, J. C.
Macoubray, R. J.
Mahan, W. C.
Marwood, J. B.
Masterman, J. W.
Mertz, Charles W.
Meyers, William F.
Miller, B. B.
Miller, J. A.
Miller, L. L.
Miller, Richard A.
Miller, Ted
Mitchell, L. C.
Mooney, J. A.
Morgenstern, G. H.
Morse, F. L.
Musgrove, W. W.
Murray, Lee J.
Myers, J. R.
McAbee, Albert W.
McCartney, S. P.
McCrea, J. G.
Neely, Harold
Noble, Robert
O'Connell, M. J.
O'Neill, Thomas J.
Pacy, D. H.
Paloney, Gerard
Pattee, A. C.
Penn, William
Perkins, E. M.
Peterson, C. D.
Pflegar, A. B.
Phillip, C. W.
Phillips, George W.
Pickels, H. D.
Prendergast, P. S.
Pringle, P. V.
aRmbo, R. E.
Ramsey, J. P.
Rehlin, T. G.
Rehlin, Walter C.
Renshaw, W. B.
Rhoads, G. A.
Rickenbach, G. S.
Rider, H. C.
Riggs, W. F.
Robertson, M. R.
Robinson, H. J.
Roscoe, Joseph
Roush, H. R.
Rush, Benjamin H.
Ryce, E. S.
Sabock, P. C.
Schadt, Alton D.
Schlieper, Charles
Schmied, William L.
Schrontz, S. B.
Schultz, W. E.
Shauck, C. E.
Sheaffer, J. H.
Sherrard, H. W.
Shotwell, Harold B.
Shropshire, Paul
Shuner, J. H.
Sieffert, W. F.
Smith, Frank D.
Smith, R. B.
Smith, Sion B.
Snyder, R. G.
Soberay, Alec A.
Starr, Guy L.
Steen, W. E.
Stemer, E. L.
Stillwagon, C. K.
Stritzinger, Thomas F.
Studybaker, A. D.
Sutphen, H. S.
Terrio, J. N.
Thomas, H. W.

Thomas, Theodore
Van Dalsem, G. A.
Van Dalsem, W. S.
Vandevort, David B.
Vogel, E. E.
Walton, H. R.
Ward, Harold
Ward, N. H.
Webb, H. C.
Weitzel, A. G.
Weitzel, C. E.
West, W. C.
Wilbraham, E. L.
Williams, John R.
Williams, J. A.
Winge, G. A.
Wittebort, Ned E.
Woernly, H. F.
Yeager, George
Yuhasm, John

PRESIDENT: We will dispense with the call of the roll as we have a record of the attendance on the registration cards.

If there is no objection, we will dispense with the reading of the minutes, as they have already been printed and distributed to you.

I will ask the Secretary to read the list of those who have been proposed for membership since our last meeting.

SECRETARY: We have the following proposals for membership:

Bacon, John L., Salesman, Cut-Off and Speed Recorder Corporation, 230 Park Avenue, New York, N. Y. Recommended by J. D. Conway.

Best, D. A., Chief Test Engineer, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

Blumling, William G., Sub-Foreman, Pressed Steel Car Company, 510 Russellwood Avenue, McKees Rocks, Pa. Recmended by G. M. Van Wormer.

Byrom, W. Reed, Material Inspector, Pressed Steel Car Company, 202 Wright Street, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

Campbell, Harry V., Electrician, Union Railroad Company, 573 Texas Avenue, Duquesne, Pa. Recommended by William J. Osborne.

Donovan, John, Sub-Foreman, Pressed Steel Car Company, 806 Frank Street, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

Duffy, D. L., Sub-Foreman, Pressed Steel Car Company, 903 Chartiers Avenue, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

Hall, Charles B., Superintendent Coal Docks, Union Railroad Company, 1600 Vermont Avenue, McKeesport, Pa. Recommended by G. M. Van Wormer.

Hollis, H., Secretary-Treasurer, Pittsburgh Incinerator Company, 213 Grandview Avenue, Mt. Washington, Pittsburgh, Pa. Recommended by J. D. Conway.

Hunt, Lawrence, General Foreman, Tank Car Department, Pressed Steel Car Company, 272 Balph Avenue, Bellevue, Pa. Recommended by G. M. Van Wormer.

Leahy, Michael F., Sub-Foreman, Pressed Steel Car Company, 3420 Fleming Avenue, N. S., Pittsburgh, Pa. Recommended by G. M. Van Wormer.

Lynch, Bernard J., Assistant Supervisor, Mon. Con. R. R., 3202 Iowa Street, Pittsburgh, Pa. Recommended by A. E. Herrold.

Masterman, T. W., Test Engineer, Westinghouse Air Brake Company, 1249 McClure Avenue, East McKeesport, Pa. Recommended by G. W. Wildin.

Mantell, W. T., Salesman, Pittsburgh Screw & Bolt Corporation, 4400 Center Avenue, Pittsburgh, Pa. Recommended by A. F. Coulter.

Mourer, Charles W., Special Work, Pressed Steel Car Company, 148 Taylor Avenue, Beaver, Pa. Recommended by G. M. Van Wormer.

Neal, E. J., Piece Work Clerk and Estimator, Pressed Steel Car Company, 1176 Dohrman Street, Stowe Township, Pa. Recommended by G. M. Van Wormer.

Pringle, P. V., Commercial Engineer, Westinghouse Air Brake Company, 811 South Avenue, Wilkinsburg, Pa. Recommended by G. W. Wildin.

Rambo, Jay B., Assistant R. F. of E., Pennsylvania Railroad, 218 Fifth Street, Aspinwall, Pa. Recommended by T. M. Blakley.

Reardon, John P., Sub-Foreman, Pressed Steel Car Company, 704 Shade Avenue, Bellevue, Pa. Recommended by G. M. Van Wormer.

Rex, Charles E., Assistant Engine House Foreman, Pennsylvania Railroad, 233 Clifton Avenue, Sharpsburg, Pa. Recommended by T. M. Blakley.

Schneider, George, Inspector, Pressed Steel Car Company, 906 Woodward Avenue, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

Snyder, H. A., Salesman, American Hoist & Derrick Company, Farmers Bank Building, Pittsburgh, Pa. Recommended by W. S. McAbee.

Waldron, F. G., Die, Jig and Fixture Man, Pressed Steel Car Company, 62 Highland Avenue, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

West, W. C., Railroad Division, Standard Oil Company of Pennsylvania, Peoples Gas Building, Pittsburgh, Pa. Recommended by W. F. Ambrose.

Whalen, Daniel J., Assistant Superintendent, Tank Department, Pressed Steel Car Company, 1144 Wayne Avenue, McKees Rocks, Pa. Recommended by G. M. Van Wormer.

PRESIDENT: These names will be referred to the Executive Committee in accordance with our By-Laws, and upon approval by them the gentlemen will become members without further action.

SECRETARY: Since our last meeting I have received information of the death of one our members, Mr. William J. Gillespie, who died May 28, 1929.

PRESIDENT: An appropriate memorial minute will appear in the next issue of the Proceedings.

I will ask the Tellers of Election to make thei rreport at this time of the result of the election.

MR. FRANK J. LANAHAN: The ballots received for the election of officers of The Railway Club of Pittsburgh, for the ensuing year, totaled 321. The ballot resulted in the unanimous election of the following:

PRESIDENT—E. W. Smith, Vice President, The Pennsylvania Railroad.

FIRST VICE PRESIDENT—Professor Louis E. Endsley, Consulting Engineer.

SECOND VICE PRESIDENT—J. E. Hughes, Superintendent, P. & L. E. R. R.

SECRETARY—J. D. Conway.

TREASURER—E. J. Searles, Manager, Schaefer Equipment Company.

EXECUTIVE COMMITTEE—Frank J. Lanahan, Chairman; A. Stucki, Samuel Lynn, D. F. Crawford, F. G. Minnick, G. W. Wildin, E. J. Devans, W. S. McAbee.

SUBJECT COMMITTEE*—C. O. Dambach, Chairman, 1 year; Karl Berg, 2 years; S. G. Down, 3 years.

ENTERTAINMENT COMMITTEE*—Charles Orchard, Chairman, 1 year; F. M. Brown, 2 years; Robert Rogers, 3 years.

FINANCE COMMITTEE*—W. C. Hansen, Chairman; T. M. Blakley, J. H. Carroll, Jr., W. P. Cunningham, 1 year; Lloyd Sutherland, 3 years.

MEMBERSHIP COMMITTEE*—E. A. Rauschart, Chairman; Otis R. Hale, J. A. Ralston, 1 year; T. E. Cannon, Guy M. Gray, C. E. Peiffer, J. S. Lanahan, 2 years; R. M. Long, Donald O. Moore, 3 years.

RECEPTION COMMITTEE*—O. L. Wright, Chairman, 1 year; Charles J. Nieman, George F. Laurent, A. B. White, F. I. Snyder, 2 years; R. H. Flinn, Col. H. C. Nutt, 3 years.

SECRETARY: I have received word from Mr. A. M. Candy that owing to pressure of other business he must resign his membership on the Subject Committee. Also the resignation of Mr. William H. Boyce, newly elected member of the Membership Committee. It will be necessary to appoint members to serve on these committees to fill the vacancies.

PRESIDENT: I offer the suggestion, for your approval, that Mr. C. O. Dambach be appointed as Chairman of the Subject Committee, to serve the unexpired term of one year of Mr. Candy, and that Mr. J. A. Ralston be appointed to serve one year on the Membership Committee in place of Mr. Boyce. On motion, the appointments as made by the President are approved.

PRESIDENT: We now come to the Annual Reports. First we will listen to the Annual Report of the Secretary.

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*In addition to newly elected committee members, the above list also gives names of those previously elected whose terms of office have not yet expired.

SECRETARY'S REPORT

Pittsburgh, Pa., October 24, 1929.

To the Officers and Members of
The Railway Club of Pittsburgh.

Gentlemen:

The following is a summary of membership and financial statement for the fiscal year ended October 24, 1929:

Reported last year	1,259	
Reinstated	4	
Received into membership during the year	141	
		1,404
Suspended, non-payment of dues	57	
Resigned	64	
Loss of address	8	
Deaths reported during the year	8	
		137
Present membership		1,267

Of the above membership four are honorary. They are: D. C. Buell, Samuel O. Dunn, Julian Kennedy and John A. Penton.

DECEASED MEMBERS

Name	Died
William J. Gillespie	May 28, 1929
Egbert H. Gold	November 3, 1928
W. H. Holbrook	February 22, 1928
L. L. Rowles	December 25, 1928
H. G. Scheck	February 16, 1929
Charles Thomas	December 15, 1928
J. S. Turner	July 15, 1929
L. H. Turner	February 22, 1929

FINANCIAL

Receipts

In hands of Treasurer at close of last year	$7,157.67	
From advertisements	2,057.20	
From dues	3,663.00	
From sale of Proceedings	20.67	
Smoker tickets and dinner October 25, 1928	747.50	
From interest, Liberty Bonds and bank balance	167.23	
Incidentals	8.00	
		$13,821.27

Disbursements

Printing Proceedings, Notices, Mailing, etc.	$2,831.92	
Hall, luncheon, cigars, etc.	956.12	
Reporting Proceedings	180.00	
Luncheon, Entertainment, etc., Smoker, October 25, 1928	1,008.25	
Messenger Service, Affidavits, etc.	24.35	
Moving pictures	40.00	
Premium on Bonds, Treasurer and Secretary.	22.50	
Floral Pieces	30.00	
Salaries and advertising expenses	1,205.72	
		$ 6,298.86
Net Balance		$ 7,522.41

Cash is made up of $5,522.41, two United States Liberty Bonds $1,000.00 each.

J. D. CONWAY, Secretary.

Approved:

FRANK J. LANAHAN, Chairman

A. STUCKI D. F. CRAWFORD
SAMUEL LYNN G. W. WILDIN
F. G. MINNICK E. J. DEVANS

Executive Committee.

PRESIDENT: Next is the Annual Report of the Treasurer.

SECRETARY: The Treasurer has handed me his report and asked me to read it.

TREASURER'S REPORT

To the Officers and Members of
The Railway Club of Pittsburgh.

Gentlemen:

I herewith submit Treasurer's Report for the year ended October 24, 1929:

ON HAND AND RECEIPTS

On hand October 25, 1928	$5,157.67	
Cash received from J. D. Conway, Secretary.	6,496.37	
Interest on Liberty Bonds	85.00	
Interest on bank balance	82.23	
Total		$11,821.27

DISBURSEMENTS

Paid on Secretary's vouchers Nos. 651 to 686, both inclusive		6,298.86
Balance		$5,522.41

RESOURCES

Two U. S. Liberty Bonds, $1,000 each	$2,000.00	
Cash balance on hand October 24, 1929	5,522.41	
Total		$ 7,522.41

E. J. SEARLES, Treasurer.

Approved:

FRANK J. LANAHAN, Chairman
A. STUCKI
SAMUEL LYNN
F. G. MINNICK
D. F. CRAWFORD
G. W. WILDIN
E. J. DEVANS
Executive Committee

We have audited the accounts of the Secretary and Treasurer, and find them correct as reported.

JOHN B. WRIGHT, Chairman,
J. H. CARROLL, JR.,
WILLIAM C. HANSEN,
Members of Finance Committee.

PRESIDENT: What is your pleasure as to these reports?

Upon motion the reports are accepted and ordered placed on file.

PRESIDENT: Next is the report of the Executive Committee, Mr. Frank J. Lanahan, Chairman.

MR. FRANK J. LANAHAN: Mr. President, Mr. Secretary and Fellow Members of the Club: Practically the only report the Executive Committee has to make is that every person who was proposed for membership during the past year was deemed eligible to join the Club.

The splendid presentation of facts by the Secretary tells the story better than anything else of the progress of our organization. At this particular time when the world seems to have been turned financially topsy-turvy, especially in the stock market, to hear Mr. Conway read the list of assets of this organization indeed gladdens the heart of all of us who are affected by the slump in Wall Street. I wonder if I may tell a little story. May I?

VOICES: Yes, go to it!

MR. LANAHAN: Down in the classic precincts of McKees Rocks, to give it a local flavor, there was a Hebrew named Jake Gould, who was not feeling any too well. He consulted one of our very good members of the medical fraternity, who looked him over, thumped his chest, counted his pulse and respiration, took his blood pressure and all that sort of thing, and said, "Mr. Gould, you come back in three or four days and I will give you the result of this examination." Jake went back in due time. The Doctor greeted him with due solemnity. He said, "Mr. Gould, how old are you?" Jakie answered that he was forty-five. "Well, well," replied the Doctor, "This is unusual, very unusual. Forty-five, and you have diabetes." "But," he continued, "with my treatment and proper diet you will be all right in a couple of years." Jake left the office and started down Chartiers Avenue. On the way he encountered Abie Cohen. Abie says, "What"s the matter, Jakie, you look as though you had lost your last friend. What's wrong, family troubles, or business worries, or what?" ' Jake answered sorrowfully, "What do you think of my tuf luck, I got diabetes at 45." "Hell," says Abie, "that"s nothin', I got Chrysler at 129."

I guess there are many others besides me hit by the drop in the stock market today. We are inclined to feel sad and depressed, but you know they say there is always a silver lining to every cloud, and my silver lining is to try to do something for somebody else. So, appearing here as the Chairman of the Executive Committee, let me cangratulate you upon the growth and the financial soundness of your Club. This gives me a rare pleasure.

A most unique organization is the Railway Club of Pittsburgh, composed as it is of all strata of commercial life. It is a matter of pride that we have in our membership, the chief executives of our large transportation systems, sometimes rather disrespectfully referred to as the occupants of the swivel chair, but it is a matter of equal pride that our membership runs the gamut of the rank and file of labor, the fellows often referred to as the horny handed sons of toil. That makes this organization one on an enduring basis—the true level of democracy. All are on the same plane no matter what the discussion may be, we are all equal.

And, gentlemen, when you stop to consider that during the year you have nine exceptionally good meetings, with splendid papers presented by outstanding individuals with full opportunity on our part to discuss any point, and to hear the discussion of others, and then later to become the recipient of the printed proceedings which contain the papers and discussion of them in book form, you can have a more vivid picture of the type of the organization.

One of the purposes of this little talk of mine is to bring home to you a realization of the importance of this Club and as there may be some among your friends and associates who would enjoy the companionship, the educational advantages and the benefits presented by this Club, the suggestion is made that you whisper in their ears an invitation to join. After you have presented their applications for membership, do not let it stop there, but bring them to the meetings until they form the contacts and the friendships that will make them regular attendants.

One other feature which should be stressed, is the feeding of the inner man. I do not know how he does it, but Mr. Conway in some miraculous manner, manages to provide out of the $3.00 which you pay for annual dues, a lunch after each meeting that is fit for any banquet hall. How good it is, is best attested by the number who stay after the meetings for this social feature.

I trust next year, under the guidance of the new executives, we will have even a better financial report and increase of membership, but if we equal the record of the year that is just past, I think we can feel satisfied.

You know it is a common saying that organizations of this kind absolutely lack sentiment; that they have no sense of gratitude, no appreciation of services received. The gathering here tonight belies that statement. We are here for one main purpose, and that is to pay to our retiring President a tribute of respect and affection. I shall not take up your time to speak about his virtues, his promptness at our meetings and the care he has exercised in the management of our affairs. Those are familiar facts to all of us, but as an evidence of our appreciation, we want our retiring President to have something tangible that he can take home to the good wife and family. Accordingly, a Committee of which Mr. Conway acted as Chairman, has something for you, Mr. McAbee, as a perpetual reminder of the affectionate regard of your fellow members of the Railway Club of Pittsburgh, and which we desire all the members to see before it goes to your home. I shall therefore, ask the President to turn around while the Secretary pulls the string that unveils the gift hanging on the wall. It is an oriental rug, beautiful in design and workmanship, and I think Mr. Conway is to be congratulated upon his good taste in its selection. May the beautiful blending of the colors in this rug, Mr. President, be emblematic of the blending of the good things of life for you in the years to come, and as you tread this rug in after years, may it bring back to you happy memories of this night and of the associations of the past year, and a full realization of the feeling of gratitude and esteem that everyone of your fellow members holds toward you. I congratulate you!

PRESIDENT: Mr. Lanahan and Fellow Members of this Club: I feel just now like I did the first night I started to preside up here. Really, I can not think what to say and I can't keep my knees just as steady as they ought to be. That is a feeling that I hope will ultimately wear off, but just now it has got me. I can not find words to express my feeling of gratitude and appreciation, not only for this beautiful memento but for the uniform courtesy and consideration shown me by the Committees and members of this Club through all my halting efforts toward its advancement during the past year. I am sure the beautiful gift will be most highly appreciated by the other part of the family. I really am not able to express myself right now, and you will have to excuse me.

It is customary after the report of the Tellers of Election to introduce the incoming officers of the Club. And first I will ask Mr. Smith, Vice President of the Pennsylvania Railroad and President-elect of the Railway Club of Pittsburgh, to make a few remarks.

MR. E. W. SMITH: Mr. McAbee and Gentlemen: I want to congratulate you upon having a president that does not make speeches. And I hope that with the able assistance of Mr. Conway as Secretary it may be possible to try at least to emulate what the retiring president has done. I hope that at the end of the coming year we may be able to show as successful results.

I do not think it necessary to say very much tonight, because we have a good many others to hear from, and entertainment features to follow. I will just say, thank you:

PRESIDENT: First Vice President, Prof. Louis E. Emdsley.

PROF. ENDSLEY: I thank you very much.

The other officers were introduced in turn, and responded with appropriate acknowledgment.

PRESIDENT: You all know your Secretary. He is going to do some more for you this evening. He is really the man behind the throne. If you do not know it I will tell you. I do not know how it would be possible for any President to carry on successfully were it not for his knowledge, advice and assistance. I will now turn the further conduct of the meeting over to Mr. Conway.

MR. J. D. CONWAY: I am rather overwhelmed with your cordial greetings. It is very unfortunate that the Chairman of the Entertainment Committee, Mr. Allderdice, is unable to be here to conduct this entertainment which he has so very able provided for this evening. He is just out of the hospital and he felt that it would be unwise for him to attempt to come out tonight.

We have a program that we hope you will all enjoy. It will not be long or tedious.

A most enjoyable program was then presented, headed by the famous Red Arrow Quartette, of the Pennsylvania Railroad, at the conclusion of which an elaborate luncheon was served.

J. D. CONWAY, Secretary.

CONSTITUTION

ARTICLE I

The name of this organization shall be "THE RAILWAY CLUB OF PITTSBURGH."

ARTICLE II

OBJECTS

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III

MEMBERSHIP

SECTION 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

SEC. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings, and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV

OFFICERS

The officers of this Club shall consist of a President, First Vice President, Second Vice President, Secretary, Treasurer, Finance Committee consisting of five or more members, Membership Committee consisting of seven or more members, Entertainment Committee consisting of three members, Reception Committee consisting of six or more members, Subject Committee consisting of three or more members, and an Elective Executive Committee of three or more members. The officers named shall serve a term of one year from date of their election, with the exception of the Finance, Membership, Entertainment, Reception and Subject Committees; the term of office of these committees shall be specified at the time of the Annual Election, but the term of office of the members of such committees shall not exceed three years.

ARTICLE V

DUTIES OF OFFICERS

SECTION 1. The President shall preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer; also serve as a member of the Executive Committee.

SEC. 2. The First Vice President, in the absence of the President, will perform all the duties of that officer; the Second Vice President, in the absence of the President and First Vice President, will perform the duties of the presiding officer. The First and Second Vice President shall also serve as members of the Executive Board.

SEC. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club Proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

SEC. 4. The Treasurer shall receipt for all moneys received from the Secretary, and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by cheque signed by the Secretary and Treasurer.

SEC. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

SEC. 6. The Finance Committee will have general supervision over the finances of the Club, and perform such duties as may be assigned them by the President or First and Second Vice Presidents.

SEC. 7. The Membership Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents and such other duties as may be proper for such a committee.

SEC. 8. The Entertainment Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents, and such other duties as may be proper for such a committee.

ARTICLE VI

ELECTION OF OFFICERS

SECTION 1. The officers shall be elected at the regular annual meeting as follows, except as otherwise provided for:

SEC. 2. Printed forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

SEC. 3. The elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

SEC. 4. The President will announce the result of the ballot and declare the election.

SEC. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot.

ARTICLE VII

AMENDMENTS

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

BY-LAWS

ARTICLE I

MEETINGS

SECTION 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Thursday of each month, except June, July and August, at 8 o'clock P. M.

SEC. 2. The annual meeting shall be held on the fourth Thursday of October each year.

SEC. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

ARTICLE II

QUORUM

At any regular or special meeting nine members shall constitute a quorum.

ARTICLE III

DUES

SECTION 1. The annual dues of members shall be Two Dollars, payable in advance on or before the fourth Thursday of September each year.

SEC. 2. The annual subscription to the printed Proceedings of the Club shall be at the published price of One Dollar. Each member of the Club shall pay for both dues and subscription. Dues and subscription paid by members proposed at the meetings in September or October shall be credited for the following fiscal year.

SEC. 3. At the annual meeting members whose dues and subscription are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

SEC. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

ARTICLE IV

ORDER OF BUSINESS

1—Roll call.
2—Reading of the minutes.
3—Announcements of new members.
4—Reports of Committees.
5—Communications, notices, etc.
6—Unfinished business.
7—New business.
8—Recess.
9—Discussion of subjects presented at previous meeting.
10—Appointment of committees.
11—Election of officers.
12—Announcements.
13—Financial reports or statements.
14—Adjournment.

ARTICLE V

SUBJECTS—PUBLICATIONS

SECTION 1. The Subject Committee will provide the papers or matter for discussion at each regular meeting.

SEC. 2. The Proceedings or such portion as the Executive Committee may approve shall be published (standard size, 6x9 inches) and mailed to the members of the Club or other similar clubs with which exchange is made.

ARTICLE VI

The stenographic report of the meetings will be confined to resolutions, motions and discussions of papers unless otherwise directed by the presiding officer.

ARTICLE VII

AMENDMENTS

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

MEMBERS

Abbott, J. A.,
Asst. Trainmaster,
Western Maryland Ry.,
Cumberland, Md.

Abraham, Walter S.,
Asst. Foreman,
Westinghouse Air Brake
319 Santos St.,
Company,
E. McKeesport, Pa.

Acheson, Walter C.,
Train Dispatcher,
A. & S. R. R. Co.,
Glenwillard, Pa.

Adams, Lewis,
Clerk, P. S. C. Co.,
McKees Rocks, Pa.

Adams, Walter A.,
Lubrication Inspector,
P. & L. E. R. R.,
230 Ohio Ave.,
Glassport, Pa.

Adler, Abe C.,
Clerk,
Union Railroad Co.,
515 South Park St.,
East Pittsburgh, Pa.

Ainsworth, J. H.,
Director of Railroad Sales
A. M. Byers Co.,
Clark Building,
Pittsburgh, Pa.

Allan, W. J.,
Sec. and Treas., Commissary
Co. of America,
1665 New Haven Ave.,
South Hills Branch,
Pittsburgh, Pa.

Allderdice, Norman,
President & Treasurer,
Arch Machinery Co., Inc.,
1005 Park Bldg.,
Pittsburgh, Pa.

Allen, E. J.,
Salesman, Ingersoll-Rand
Co., 706 Chamber of
Commerce Bldg.,
Pittsburgh, Pa.

Allen, Harvey,
Consulting Engineer,
347 Columbia Ave.,
West View,
Pittsburgh, Pa.

Allen, James P.,
President,
Union Steel Casting Co.,
62nd and Butler Sts.,
Pittsburgh, Pa.

Allison, John,
Sales Engineer,
Pgh. Steel Foundry Corp.,
Glassport, Pa.

Altsman, W. H.,
Mechanical Engineer,
Harmony Railways,
67 Watsonia Blvd.,
N. S., Pittsburgh, Pa.

Ambrose, W. F.,
M. M., Aliquippa & So. R. R.,
1301 Meadow St.,
Aliquippa, Pa.

Anderson, G. S.,
Foreman,
Penna. System,
Box 19, Penna. Station,
Pittsburgh, Pa.

Anger, C. E.,
Upholsterer Foreman,
P. & L. E. R. R.,
15 Richey Ave.,
N. S., Pittsburgh, Pa.

Anger, John G.,
General Foreman,
P. & L. E. R. R.,
Fifth Ave.,
Coraopolis, Pa.

Anne, George E.,
Representative,
American Brake Shoe &
Foundry Co.,
1101 Fourteenth Ave.,
Altoona, Pa.

Antes, Edwin L.,
General Foreman.
Pressed Steel Car Co.,
11 Frazier Ave.,
McKees Rocks, Pa.

Anthony, J. T.,
Vice President,
General Refractories Co.,
420 Lexington Ave.,
New York, N. Y.

Anthony, R. H.,
Freight Claim Agent,
P. & L. E. R. R.,
424 Terminal Bldg.,
Pittsburgh, Pa.

Arensberg, F. L.,
President,
Vesuvius Crucible Co.,
Box 47,
Swissvale, Pa.

Armstrong, J. B.,
Sales Manager,
Monongahela Iron & Steel
Company,
2208 First Nat Bank
Bld.,
Pittsburgh, Pa

Armstrong, M. H.,
Asst. Yardmaster,
Mon. Con. R. R. Co.,
250 Freeport Ave.,
Mt. Oliver Station,
Pittsburgh, Pa.

Arnold, J. J.,
Sales Dept.,
Pressed Steel Car Co.,
1915 Farmers Bank Bldg.,
Pittsburgh, Pa.

Ashley, F. B.,
Gen'l. Sales Manager,
Pruett Schaffer Chemical Co.,
Tabor St.,
Corliss Sta.,
Pittsburgh, Pa.

Ashton, Wm. A.,
Die Foreman,
Schoen Works,
Carnegie Steel Co.,
1031 Tyndall St.,
Sheraden, Pa.

Atterbury, W. W.,
President, P. R. R. Co.,
Broad St. Sta.,
Philadelphia, Pa.

Aulbach, A. J.,
Yardmaster, P. & L. E. R. R.,
318 Quincy Ave.,
Mt. Oliver Sta.,
Pittsburgh, Pa.

Averman, E. J.,
Vice Pres. and Treas.,
General Bronze Co.,
822 Chislett St.,
Pittsburgh, Pa.

Ayers, H. B.,
President,
H. K. Porter Co.,
49th St. and A. V. Ry.,
Pittsburgh, Pa.

Babcock, F. H.,
Safety Agent,
P. & L. E. R. R.,
415 House Bldg.,
Pittsburgh, Pa.

Bachner, Martin G.,
P. W. I.—P. & L. E. R. R.,
1109 Church Ave.,
McKees Rocks, Pa.

Bacon, John L.,
Salesman,
Cut-off & Speed Recorder
Corporation
230 Park Ave.,
New York, N. Y.

Baer, Harry L.,
Pres. Water Treatment Co. of
America,
2716 Grant Bldg.,
Pittsburgh, Pa.

Bailey, F. G.,
Mechanical Engineer,
Standard Motor Truck Co.,
Butler, Pa.

Baily, J. H.,
Secy., Edgewater Steel Co.,
Oakmont, Pa.

Bain, Geo. F.,
Representative,
Copperweld Steel Co.,
Room 526,
30 Church St.,
New York, N. Y.

Bair, J. K.,
Locomotive Engineer,
Union Railroad,
139 Brown Ave.,
Turtle Creek, Pa

Baird, F. C.,
General Manager,
P. & W. Va. Ry.,
Wabash Building,
Pittsburgh, Pa.

Baker, H. M.,
Clerk,
Aliquippa & Southern R. R.,
Monaca Natl. Bank Bldg,
Monaca, Pa.

Baker, J. B.,
Chief Engr., M. of W.,
Pennsylvania Railroad,
Pennsylvania Station,
Pittsburgh, Pa.

Bakewell, Donald C.,
President, Duquesne Steel
Foundry Co.,
Union Bank Bldg.,
Pittsburgh, Pa.

Bald, E. J.,
General Foreman,
Westinghouse E. & M. Co.,
2105 Lloyd Ave.,
Swissvale, Pa.

Ball, Fred M.,
District Manager,
Franklin Ry. Sup. Co., Inc.
1200 Cunard Building,
Philadelphia, Pa.

Ball, George L.,
Treasurer,
Ball Chemical Co.,
230 S. Fairmont Ave.,
Pittsburgh, Pa.

Balzer, C. E.,
Asst. Air Brake Supervisor,
P. & L. E. R. R.,
3133 West Carson St.,
Pittsburgh, Pa.

Bandi, E. John,
Bill Clerk, P. C. & Y. R. R.,
1115 Criss St.,
Pittsburgh, Pa

Bandish, Jos. M.,
District Manager,
Durametallic Corporation,
35 E. Wacker Drive,
Chicago, Ill.

Barclay, J. R.,
Cost Engineer,
P. & L. E. R. R.,
4 Oakwood Road,
Crafton, Pittsburgh, Pa.

Barnett, Geo.,
Salesman,
W. W. Lawrence Co.,
West Carson St.,
Pittsburgh, Pa.

Barney, Harry,
President-Treasurer,
Barney Machinery Co., Inc.,
2410 Koppers Bldg.,
Pittsburgh, Pa.

Barnhart, F. L.,
Secretary,
Union Collieries Co.,
2212 Oliver Bldg.,
Pittsburgh, Pa.

Barr, H. C.,
Agent, P. & L. E. R. R.,
3134 West Liberty Ave.
So. Hills Station,
Pittsburgh, Pa.

Bartholomew, W. S.,
Alder Court Apts.,
East End, Pittsburgh, Pa.

Batchelar, E. C.,
Manager, The Motch &
Merryweather Mach'y Co.,
1315 Clark Bldg.,
Pittsburgh, Pa.

Bateman, W. H. S..
W. H. S. Bateman & Co.,
Commercial Trust Bldg.,
Philadelphia, Pa.

Bates, H. W.,
Manager of Sales,
Pgh. Testing Laboratory,
P. O. Box 1115,
Pittsburgh, Pa.

Bayer, George J.,
American Rolling Mill Co.,
112 Cross St.,
Butler, Pa.

Beam, E. J.,
Car Builder, Penna. System,
577 Fourth St.,
Pitcairn, Pa.

Beattie, J. A.,
General Superintendent,
McKeesport Con. R. R.,
1923 Frick Building,
Pittsburgh, Pa.

Beatty, George W.,
P. W. I.—P. & L. E. R. R.,
Dickerson Run, Pa.

Beck, Carl H.,
General Sales Manager,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Bednar, Jos. J.,
Master Mechanic,
Witherow Steel Co.,
347 Helen St.,
McKees Rocks, Pa.

Beegel, F. W.,
Chief Clerk,
Union Steel Casting Co.,
62nd and Butler Sts.,
Pittsburgh, Pa.

Beers, W. E.,
Sheet Metal Worker,
P. & L. E. R. R.,
P. O. Box No. 8,
Dawson, Pa.

Beeson, H. L.,
Inspector,
Monongahela Ry. Co.,
West Brownsville, Pa.

Beitzel, H. L.,
C. C. to Traffic Manager,
P. & L. E. R. R.,
1328 Rutherford Ave.,
Pittsburgh, Pa.

Beltz, John D.,
Supt., B. & O. R. R.,
So. Windsor Apts.,
Connellsville, Pa.

Bennett, Alonzo H.,
General Foreman,
B. R. & P. Ry.,
520 S. State St.,
Du Bois, Pa.

Bennett, Robert George,
General Superintendent M. P.,
P. R. R. System,
General Offices,
Philadelphia, Pa.

Benson, G. W.,
C. C. to Div. Engineer,
B. R. & P. Ry.,
413 W. Du Bois Ave.,
Du Bois, Pa.

Berg, Karl,
Asst. Supt. Motive Power,
P. & L. E. R. R.,
6319 Morrowfield Ave.,
Pittsburgh, Pa.

Berghane, A. L.,
Mechanical Expert,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Bernoulli, W. H.,
Pugh Bros.,
211 House Bldg.,
Pittsburgh, Pa.

Best, D. A.,
Chief Test Engineer,
Westinghouse Airbrake Co.
Wilmerding, Pa.

Bevan, P. A.,
Asst. Works Manager,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Bier, Edward C.,
Yardmaster,
Mon. Con. R. R.,
117 Duffland Ave.,
Mt. Oliver, Pittsburgh, Pa.

Bigleman, E. P.,
Yard Master,
P. & W. Va. Ry.,
Gormley Ave.,
Carnegie, Pa.

Bihler, L. C.,
Asst. to Pres. and General
Traffic Manager,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Binkley, Walter E.,
Asst. Car Foreman,
Union Railroad Co.,
No. 131 Unity, Pa.

Bishop, C. L.,
Chief Clerk,
Pittsburgh, Mahoning and
Shenango Valley Freight
Committee,
606 Chamber of
Commerce Bldg.,
Pittsburgh, Pa.

Blackall, Robert H.,
1 East Forty-second St.,
New York, N. Y.

Blackmore, G. A.,
President & General Mgr.
Union Switch & Signal Co.
Swissvale, Pa

Blackwell, W. B.,
Lubrication Engineer,
The Texas Co.,
31 E. Washington St.,
Hagerstown, Md.

Blair, John R.,
Asst. General Mgr. of Sales,
Pittsburgh Steel Products Company,
Union Trust Bldg.,
Pittsburgh, Pa.

Blakley, T. M.,
R. F. of E., Penna. R. R.,
101 Emerson Ave.,
Aspinwall, Pa.

Blest, Minot C.,
Chief Engineer,
Pressed Steel Car Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Blumling, Wm. G.,
Sub-Foreman,
Pressed Steel Car Co.,
510 Russellwood Ave.,
McKees Rocks, Pa.

Boate, H. S.,
Piece Work Inspector,
P. & L. E. R. R.,
438 Russelwood Ave.,
McKees Rocks, Pa.

Bond, W. W.,
Asst. R. F. of E.,
Pennsylvania R. R.,
3744 Mississippi St.,
San Diego, Calif.

Bonhoff, E. L.,
Gen. Fore. Penna. Railroad,
626 Hastings St.,
E. E., Pittsburgh, Pa.

Booth, J. K.,
Master Mechanic,
B. & L. E. R. R.,
No. 8 Penn Ave.,
Greenville, Pa.

Borchers, E. A.,
Office Engineer, Bridge Dept.,
Pennsylvania R. R.,
500 Peebles St.,
Pittsburgh, Pa.

Borg, John Edw.,
Chief Draftsman,
Julian Kennedy,
232 Martsolf Ave.,
West View, Pa.

Bottomly, E. S.,
Chief Joint Inspector,
P. R. R., B. & O.,
Rdg., and W. M.,
Martinsburg, W. Va.

Bourke, John P.,
Vice President,
Ewald Iron Co.,
501 Fifth Ave.,
New York, N. Y.

Bowden, Foster S.,
Asst. Supervisor,
Pennsylvania Railroad,
510 Ferndale Ave.,
Johnstown, Pa.

Bowden, T. C.,
Coal Inspector,
B. & L. E. R. R.,
97 S. Mercer St.,
Greenville, Pa.

Bowen, James T.,
Car Foreman,
Union Railroad,
Box 163,
Unity, Pa.

Bowers, John M.,
Clerk,
Union Railroad,
1203 Swissvale, Ave.,
Wilkinsburg, Pa.

Bowery, Frank J.,
Chief Estimator, F. C. D.,
P. S. C. Co.,
214 Birmingham Ave.,
Avalon, Pa.

Bowler, R. W. E.,
Division Engineer,
P. R. R. System,
207 Pennsylvania Sta.,
Pittsburgh, Pa.

Boyle, Edward A.,
Salesman, The Okonite Co.,
First National Bank Bldg.,
Pittsburgh, Pa.

Braden, Lou,
District Sales Manager,
Wyoming Shovel Works,
First Natl. Bank Bldg.,
Pittsburgh, Pa.

Bradley, W. C.,
C. C. to Gen'l. Supt.,
Union R. R.,
1808 Lafayette St.,
Swissvale, Pa.

Brady, H. K.,
Supt., Labor & Wage Bureau
Penna. System,
720 Penna. Station,
Pittsburgh, Pa.

Brady, T. Joseph,
President,
Vanderbilt Coal & Coke Co.,
303 Kearsarge St.,
Mt. Washington Sta.,
Pittsburgh, Pa.

Brant, Wm. J.,
1001 Bessemer Bldg.,
Pittsburgh, Pa.

Braun, L. H.,
Planner,
Pressed Steel Car Co.,
256 Beringer Place,
Bellevue, Pa.

Braun, Otto F.,
Gen. Mach Shop Foreman
P. & L. E. R. R.,
R. D. 1—Herbst Road,
Coraopolis, Pa.

Brendlinger, M. T.,
Shop Inspector,
Penna. R. R. System,
444 Third St.,
Pitcairn, Pa.

Brennan, John T.,
Asst. Vice Pres.,
Greenville Steel Car Co.,
Greenville, Pa.

Brennan, T. F.,
Vice President.
B. R. & P. Ry. Co.,
155 Main St., West,
Rochester, N. Y.

Brewer, H. W.,
Supt. of Shops,
B. R. & P. Ry.,
Du Bois, Pa.

Brewster, Morris B.,
Pres. and Gen. Mgr.,
Morris B. Brewster, Inc.,
332 S. Michigan Ave.,
Chicago, Ill.

Brice, James A.,
Chief Train Disp's.,
P. & L. E. R. R.,
411 Cohassett Road,
Youngstown, Ohio.

Brinkhoff, W. H.,
Draftsman, P. & L. E.
R. R., 13 Willow St.,
Emsworth, Pa.

Brogan, J. E.,
Passenger Conductor,
B. R. & P. Ry.,
397 E. Utica St.,
Buffalo, N. Y.

Brose, J. A.,
Mechanical Inspector,
P. & L. E. R. R.,
McKees Rocks, Pa.

Brosius, E. E.,
President,
Official Ry. Guide Pub Co.,
Investment Bldg.,
Pittsburgh, Pa.

Brower, J. E.,
Master Mech., Penna. System,
2130 N. Anthony Blvd.,
Ft. Wayne, Ind.

Brown, C. C.,
Rep., Dearborn Chemical Co.,
618 Farmers Bank Bldg.,
Pittsburgh, Pa.

Brown, Charles L.,
Foreman, R. R. Dept.,
Westinghouse Airbrake Co.,
666 Airbrake Ave.,
Wilmerding, Pa.

Brown, E. C.,
Chief Civil Engineer,
Carnegie Steel Co.,
Room 1012,
Carnegie Building,
Pittsburgh, Pa.

Brown, F. A.,
Chief Clerk, Freight Claim
Office, P. & L. E. R. R.,
87 South Sixteenth St.,
Pittsburgh, Pa.

Brown, F. M.,
Supt., P. & L. E. R. R. Co.,
Pittsburgh, Pa.

Brown, J. Alexander,
424 W. 33rd St.,
Eleventh Floor,
New York, N. Y.

Brown, John T., Jr.,
Supt., Federated Metal Corp.,
6667 Woodwell St.,
Pittsburgh, Pa.

Brown, W. E.,
Asst. Chf. Engr., M. of W.,
Penna. System,
1114 Penna. Station,
Pittsburgh, Pa.

Browne, Bard,
Asst. to Vice President,
The Superheater Co.,
17 East 42nd St.,
New York, N. Y.

Bruce, S. S.,
Traffic Manager,
The Koppers Co.,
Union Trust Bldg.,
Pittsburgh, Pa.

Brueckner, Anthony J.,
Gang Foreman,
Penna. Railroad System,
1610 Lowrie Street,
Pittsburgh, Pa.

Brunner, Carl H.,
Representative,
Joyce-Cridland Co.,
609 Avery St.,
N. S., Pittsburgh, Pa.

Buckbee, W. A.,
The Superheater Co.,
Nyack, N. Y.

Buell, D. C.,
Director, The R'wy Educational Bureau,
1809 Capitol Ave.,
Omaha, Neb.

Buffington, W. P.,
Traffic Mgr.,
Pittsburgh Coal Co.,
P. O. Box 64,
Pittsburgh, Pa.

Bull, R. S.,
Supt. of Equipment,
Pittsburgh Railways Co.,
435 Sixth Ave.,
Pittsburgh, Pa.

Burel, W. C.,
Master Mechanic,
Western Allegheny R. R.,
Kaylor, Pa.

Burgham, Maurice L.,
Sales Engineer,
Edgewater Stele Co.,
440 Freeport St.,
Parnassus, Pa.

Burkley, Frank H.,
Gang Foreman, Car Dept.,
Union Railroad,
Box 262,
Unity, Pa.

Burnes, J. E.,
Supt. Car Service,
B. R. & P. Ry. Co.,
133 Warwick Ave.,
Rochester, N. Y.

Burnette, G. H.,
Chief Engineer,
Monongahela Railway Co.,
Brownsville, Pa.

Burns, E. A.,
District Claim Agent,
B. R. & P. Ry.,
20 E. Long Ave.,
DuBois, Pa.

Button, D. G.,
Yardmaster,
P. & L. E. R. R.,
Dickerson Run, Pa.

Byers, Q. S.,
Asst. E. H. Foreman,
P. R. R. System,
1683 Morningside Ave.,
Pittsburgh, Pa.

Byrne, William L.,
Carpenter and Byrne,
House Bldg.,
Pittsburgh, Pa.

Byrom, W. Reed,
Material Inspector,
Pressed Steel Car Co.,
202 Wright St.,
McKees Rocks, Pa.

Cady, P. C.,
Railway Supplies,
30 Church St., Room 506,
New York City

Cairns, Joseph H.,
Clerk, Coal Traffic Dept.,
Pennsylvania R. R. Co.,
452 Wayne St.,
Beaver, Pa.

Caldwell, C. W.,
Rep., James B. Sipe & Co.,
Chamber of Commerce Bldg.,
Pittsburgh, Pa.

Callahan, F. J.,
Engine House Foreman,
Montour Railroad,
1214 Third St.,
West Park,
McKees Rocks, Pa.

Callahan, Lawrence H.,
Yardmaster, P. & L. E. R. R.,
600 Monongahela Ave.,
McKeesport, Pa.

Calvert, H. W.,
General Foreman,
P. & L. E. R. R.,
518 West Cherry St.,
New Castle, Pa.

Campbell, C. A.,
Agent, B. R. & P. Ry.,
509 E. Moody Ave.,
New Castle, Pa.

Campbell, Edward D.,
Gen. Fr't. Agt.,
B. & L. E. R. R.,
P. O. Box 456,
Pittsburgh, Pa.

Campbell, Harry V.,
Electrician,
Union Railroad Co.,
573 Texas Ave.,
Duquesne, Pa.

Campbell, James E.,
Agent, P. & L. E. R. R.,
512 Twelfth Avenue,
Munhall, Pa.

Campbell, J. T.,
Agent,
B. & O. R. R. Co.,
Thirty-third St.,
Pittsburgh, Pa.

Cannon, J.,
Vice Pres. & Gen. Mgr.,
Missouri Pacific R. R. Co.,
St. Louis, Mo.

Cannon, T. E.,
Gen. Supt., Locos. &
Equipment,
P. & W. Va., Ry.,
Wabash Bldg.,
Pittsburgh, Pa.

Canterbury, L. E.,
Telegraph Operator,
P. & L. E. R. R.,
P. O. Box 86,
Newell, Pa.

Cardwell, J. R.,
Pres., Union Draft Gear Co.,
332 S. Michigan Ave.,
Chicago, Ill.

Carlson, Frank R.,
Sales Dept., Chicago Rwy.,
Equipment Co.,
1557 Rwy. Exch. Bldg.,
Chicago, Ill.

Carlson, Lawrence,
Westinghouse Air Brake Co.,
353 Marguerite Ave.,
Wilmerding, Pa

Carnahan, W. E.,
Treas., Nat. Casket Co., Inc.,
2216 Oliver Bldg.,
Pittsburgh, Pa.

Carr, T. W.,
Mechanical Engineer,
P. & L. E. R. R.,
Smithfield St.,
Pittsburgh, Pa.

Carroll, J. H., Jr.,
Freight Traffic Manager,
B. & O. R. R..
921 Oliver Bldg.,
Pittsburgh, Pa.

Carson, G. E.,
"Retired" M. C. B.,
N. Y. C. R. R. Co.,
715 Western Ave.,
Albany, N. Y.

Carson, John,
Supt. Equip't., Ft. Pitt
Malleable Iron Co.,
1705 Morningside Ave.,
Pittsburgh, Pa.

Carter, William,
Purchasing Agent,
Rees Manufacturing Corp.,
7501 Thomas Blvd.,
Pittsburgh, Pa.

Carthew, John W.,
Engineer of Inspection,
Westinghouse Air Brake,
241 Welsh Ave.,
Wilmerding, Pa.

Cartwright, Wm. E.,
Pgh. District Mgr.,
National Bearing Metals
Corp.,
928 Shore Ave.,
N. S., Pittsburgh, Pa.

Cathers, C. E.,
Commercial Freight Agent,
B. R. & P. Ry.,
529 Smithfield St.,
Pittsburgh, Pa.

Caton, S. W.,
Master Car Builder,
W. M. R. R.,
Hagerstown, Md.

Chaffin, H. B.,
M. M.,
Pennsylvania Railroad,
711 Lexington Ave.,
Altoona, Pa.

Chalker, A. R.,
Mechanical Engineer,
William K. Steamets,
473 Dawson Ave.,
Bellevue, Pa.

Champion, James H.,
Chief Clerk,
Penna. R. R. System,
Box 164, R. F. D. 2,
Sharpsburg, Pa.

Chaney, James A.,
General Secretary,
P. & L. E.—Y. M. C. A.,
Dickerson Run, Pa.

Cherry, Jas. T.,
Roadmaster,
P. & W. Va., Ry.,
626 Grandview Ave.,
Carnegie, Pa.

Chilcoat, H. E.,
Manager of Sales,
Air Dump Car Division,
Koppel Industrial Car &
Equipment Co.,
Koppel, Pa.

Chittenden, A. D.,
Supt. Transportation,
B. & L. E. R. R.,
P. O. Box 456,
Pittsburgh, Pa.

Christfield, J. G.,
Mechanical Engineer,
American Rolling Mill Co.,
Butler, Pa.

Christianson, A.,
Chief Engineer,
Standard Steel Car Co.,
Butler, Pa.

Christy, F. X.,
Inspector,
P. R. R.,
4121 Davison St.,
Arsenal Sta.,
Pittsburgh, Pa.

Church, C. C.,
Spec. Agt., Pgh. Coal Co.,
54 Hodgson Ave.,
Crafton Station,
Pittsburgh, Pa.

Church, C. R.,
M. M., Union R. R.,
319 Larimer Ave.,
Turtle Creek, Pa.

Cipro, Thomas,
Car Inspector,
Union Railroad Co.,
Box 204,
Unity, Pa.

Clark, C. C.,
Gen. Sales Agent,
Central Dist.,
Pressed Steel Car Co.,
P. O. Box 53,
Pittsburgh, Pa.

Clark, Chas. H.,
Pres., Clark Car Co.,
1310 Clark Building,
Pittsburgh, Pa.

Clark, Edward J.,
Spt. Electric Construction,
Byllesby Engr. & Man. Corp.,
2927 Mattern Ave.,
Dormont,
Pittsburgh, Pa.

Clement, M. W.,
Vice Pres.-Operation,
Penna System
Broad Street Station,
Philadelphia, Pa.

Clements, B. A.,
President,
American Arch Co., Inc.,
17 E 42nd St.,
New York City, N. Y.

Clements, Frank C.,
Foreman, P. & L. E. R. R.,
844 Island Avenue,
McKees Rocks, Pa.

Clunan, Patrick F.,
Chief Waybill Clerk,
P. & L. E. R. R.,
1101 Grandview Ave.,
Mt. Washington Sta.,
Pittsburgh, Pa

Coates, W. T.,
Inspector,
Westinghouse Air Brake Co,
328 James Street,
Turtle Creek, Pa

Cobb, Candler,
Vice President,
O. C. Durvea Corp'n.,
230 Park Ave.,
New York, N. Y.

Code, Charles J.,
Supervisor, Penna. System,
304 West 10th St.,
Tyrone, Pa.

Code, J. G.,
Vice Pres. and Gen. Mgr.,
Jefferson-S'western R. R. Co.,
Mt. Vernon, Ill.

Coffin, C. W. Floyd,
Vice President,
Franklin Railway Supply
Co., Inc.,
17 E. 42nd St.,
New York, N. Y.

Coffin, J. S.,
Chairman, Franklin Ry.
Supply Co.,
17 E. 42 nd St.,
New York, N. Y.

Cogswell, F. R.,
Director of Traffic Promotion,
Pittsburgh Railways Co.,
435 Sixth Ave.,
Pittsburgh, Pa.

Cohen, Alfred J.,
Westinghouse Air Brake Co.,
350 So. Highland Ave.,
Pittsburgh, Pa.

Coleman, J. D.,
Blacksmith Foreman,
Montour Railroad,
512 Seventeenth St.,
Beaver Falls, Pa.

Coleman, Jacob C.,
Clerk, Union R. R. Co.,
717 Middle St.,
Braddock, Pa.

Coleman, L. G.,
Manager, Locomotive Dept.,
Ingersoll-Rand Co.,
11 Broadway,
New York, N. Y.

Conlon, John F.,
Clerk, P. & L. E. R. R.,
547 Canal St.,
Beaver, Pa.

Conner, W. P.,
P. O. Box 132,
Wilkinsburg, Pa.

Connolly, E. V.,
Chief Clerk & Cashier,
P. & L. E. R. R.,
Rankin, Pa.

Conway, J. D.,
Sec'y-Treas., Railway Supply
Manufacturer's Association,
1841 Oliver Bldg.,
Pittsburgh, Pa.

Coombe, A. B.,
Asst. Superintendent,
Pressed Steel Car Co.,
1515 Quail Ave.,
Bellevue, Pa.

Cooper, Sidney B.,
Mgr. Railway Engineering,
Westinghouse Elec. & Mfg
Company,
East Pittsburgh, Pa.

Cope, E. E.,
Master Mechanic,
B. R. & P. Ry.,
101 So. Franklin St.,
DuBois, Pa.

Copeland, T. A.,
Train Master,
P. & L. E. R. R.,
688 McKee Ave.,
Monessen, Pa.

Copeland, Thomas T.,
Carnegie Steel Co.,
Munhall, Pa.

Corcoran, James M.,
Inspector,
Mon. Con. R. R.,
4002 Coleman St.,
Pittsburgh, Pa.

Cotter, George L.,
District Engineer,
Westinghouse Airbrake Co.,
353 Marguerite Ave.,
Wilmerding, Pa.

Coulter, A. F.,
M. C. B., Union R. R. Co.,
East Pittsburgh, Pa.

Courtney, Harry,
Shop Supt., P. & L. E.,
520 Giffin Ave.,
Mt. Oliver Sta.,
Pittsbrgh, Pa.

Covey, H. S.,
Sec'y., The Cleveland Pneu.
Tool Co.,
3734 East 78th St.,
Cleveland, Ohio

Cox, Alfred M.,
President,
Pgh. Com'l. Heat Treat. Co.,
1374 Marlboro Ave.,
Wilkinsburg, Pa.

Cox, W. E.,
Asst. Supt.,
Mon. Con. R. R.,
2535 Brownsville Ave.,
Pittsburgh, Pa.

Craig, John R.,
District Manager,
Buckeye Chemical Co.,
5621 Wellesley Ave.,
E. E., Pittsburgh, Pa.

Craig, W. J.,
Dist. Boiler Inspector,
B. & O. R. R.,
321 Johnston Ave.,
Hazelwood, Pittsburgh, Pa.

Cramblitt, Thomas L.,
Supervisor,
Locomotive Operation,
B. & O. R. R.,
527 Louisiana Ave.,
Cumberland, Md.

Crary, Henry S.,
General Manager,
Fort Pitt Spring Co.,
P. O. Box 917,
Pittsburgh, Pa.

Crawford, D. F.,
Consulting Engineer,
5243 Ellsworth Ave.,
Pittsburgh, Pa.

Crawford, G. M.,
President,
Crawford Machinery Co.,
611 Bessemer Bldg.,
Pittsburgh, Pa.

Creighton, David M.,
Engineering Computer,
P. & L. E. R. R.,
717 Tenth Ave.,
New Brighton, Pa.

Cremer, Jos. A.
Dist. Mgr., Dearborn
Chemical Co.,
618 Farmers Bank Bldg.,
Pittsburgh, Pa.

Crispen, Raymond B.,
Timekeeper, Union Railroad,
420 South Ave.,
Wilkinsburg, Pa.

Croft, C. A.
R. R. Rep., A. M. Byers Co.,
Clark Building,
Pittsburgh, Pa.

Croke, Thos. F.
Foreman,
Ft. Malleable Iron Co.,
3102 Bergman St.,
Pittsburgh, Pa.

Cromwell, H. T.,
Asst. Shop Supt.,
B. & O. R. R.,
720 Shady Ave.,
Mt. Lebanon, Pa.

Cross, Harry W.,
Works Manager,
Putnam Machine Works,
Manning Maxwell &
Moore, Inc.,
Fitchburg, Mass.

Crouse, J. M.,
Asst. Supt.,
P. & W. Va. Ry.,
Wabash Bldg.,
Pittsburgh, Pa.

Crowe, J. M.,
Pres., Crowe Mfg. Corp.,
317 Sycamore St.,
Cincinnati, Ohio

Cruikshank, J. C.,
Div. Engr., P. & W. Va. Ry.,
439 Wabash Bldg.,
Pittsburgh, Pa.

Cullen, James K.,
President,
Niles Tool Works,
Hamilton, Ohio

Cunningham, J. L.,
Asst. to Gen. Supt. Mo Power,
Pennsylvania Railroad,
519 Penna. Station,
Pittsburgh, Pa.

Cunningham, R. I.,
Mech. Engr., W. A. B. Co.,
436 Franklin Ave.,
Wilkinsburg, Pa.

Cunningham, W. P.,
Supt. Motive Power,
Monongahela Railway Co.,
3169 Ashlyn Street,
Pittsburgh, Pa.

Curly, Walter J.,
President and General Mgr.,
Conley Tank Car Co.,
Oliver Building,
Pittsburgh, Pa.

John Currie,
Storehouse Attendant,
P. & L. E. R. R.,
43 Evans Ave.,
Ingram, Pa.

Daley, John,
Cond'r., P. C. & Y. Ry.,
Yard Office,
McKees Rocks, Pa.

Daly, P. J.,
Wheel Shop Foreman,
Penna. Railroad System,
3145 W. Carson St.,
Corliss Station,
Pittsburgh, Pa.

Dalzell, W. E.,
Asst. Planner,
Pressed Steel Car Co.,
1014 Milton St.,
Coraopolis, Pa.

Dambach, C. O.,
Supt. P. & W. Va. Ry.,
Wabash Bldg.,
Pittsburgh, Pa.

Damore, S. A.,
Steam Ditcher Engr.,
P. & L. E. R. R.,
P. O. Box 1511,
Monessen, Pa.

Damrau, Edward A.,
Dist. Mgr., The Okonite Co.,
First National Bank Bldg.,
Pittsburgh, Pa.

Danforth, G. H.,
Contracting Engineer,
J. & L. Steel Co.,
3rd Ave. and Ross St.,
Pittsburgh, Pa.

Darrall, William G.,
Draftsman,
Edgewater Steel Co.,
347 James St.,
Springdale, Pa.

Darr, Elsworth E.,
Yardmaster,
P. & L. E. R. R.,
235 Meridan Street,
Mt. Washington,
Pittsburgh, Pa.

Dashiell, J. W.,
Ticket Agent,
B. & O. R. R. Co.,
Glenwood Station,
Pittsburgh, Pa.

Daugherty, W. A.,
Gang Fore., Car Dept.,
Union Railroad,
Box 281,
Universal, Pa.

Davern, F. C.,
Sales Engineer,
Nathan Manufacturing Co.,
123 Carmel Road,
Buffalo, N. Y.

Davin, W. E.,
Supervisor,
P. & L. E. R. R.,
340 Russellwood Ave.,
McKees Rocks, Pa.

Davis, A. G.,
Superintendent,
Pittsburgh, Allegheny &
McKees Rocks R. R.,
McKees Rocks, Pa.

Davis, Chas. S.,
Traffic Mgr.,
Standard Tin Plate Co.,
Canonsburg, Pa.

Davis, W. B.,
Claim Agent,
B. R. & P. Ry.,
155 Main St., West,
Rochester, N. Y.

Davison, Charles R.,
Chief Draftsman,
Standard Stoker Co.,
832 Malvern Road,
Avalon, Pittsburgh, Pa.

Day, George W. C.,
Telegraph Censor,
B. & O. R. R.
718 North Ave.,
Wilkinsburg, Pa.

Deckenbaugh, Andrew L.,
Chief Clerk of Accounts,
P. & L. E. R. R.,
Room 25 P. & L. E.
Annex Building,
Pittsburgh, Pa.

Deckman, E. J.,
Pres., E. J. Deckman Co.,
902 Oliver Bldg.,
Pittsburgh, Pa.

Dehne, G. C.,
Asst. to Vice Pres.,
W. A. B. Co.,
Wilmerding, Pa.

DeLaney, Grover C.,
Fore. Constr'n.,
Ally. Co. Road Dept.,
321 Ohio Ave.,
Glassport, Pa.

DeLaney, V. W.,
Superintendent Transp'n.,
Youngstown Sheet & Tube
Company,
Youngstown, Ohio

DeLeon, P.,
Supt. Power Plant,
Pgh. Terminal Coal Co.,
Wabash Bldg.,
Pittsburgh, Pa.

Dempsey, P. W.,
Supt. West. Machine Shop,
Westinghouse Air Brake Co.,
269 N. Dithridge St.,
Pittsburgh, Pa.

Dennis, J. G.,
Freight Train Master,
Pennsylvania R. R. System,
324 Pennsylvania Station,
Pittsburgh, Pa.

Depner, Michael,
Hammersmith,
P. & L. E. R. R.,
306 Grove St.,
McKees Rocks, Pa.

Derr, A. I.,
Asst. to V. P. & G. M.,
P. & W. Va. Ry.,
Wabash Bldg.,
Pittsburgh, Pa.

Descamp, J.,
Car Inspector,
Union Railroad,
514 Watson St.,
Hays, Pa.

Desch, John L.,
Sales Engineer,
Clark Car Co.,
Clark Bldg.,
Pittsburgh, Pa.

Devans, E. J.,
Gen. Supt.,
B. R. & P. Ry.,
Du Bois, Pa.

Dickinson, F. W.,
M. C. B.,
B. & L. E. R. R. Co.,
117 Clinton St.,
Greenville, Pa.

Diehl, A. N.,
Vice President,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa

Diven, J. B.,
Supt. Motive Power,
P. R. R. System,
502 Pennsylvania Sta.,
Pittsburgh, Pa.

Dixon, T. L.,
Foreman Mechanical Dept.
Union Railroad,
110 Shaw Ave.,
Turtle Creek, Pa.

Doane, F. B.,
Chemical Salesman,
Pittsburgh Test'n Lab.,
Stevenson & Locust Sts.,
Pittsburgh, Pa

Doemling, Joseph J.,
Sheet Metal Worker,
Kirch Sheet Metal Co.,
3465 Ligonier St.,
Pittsburgh, Pa.

Donaldson, Charles E.,
General Yardmaster,
P. & L. E. R. R.,
8 East Laurel Ave.,
New Castle, Pa.

Donaldson, Warren A.,
Clerk, B. & L. E. R. R.,
3235 Gaylord Ave.,
South Hills,
Pittsburgh, Pa.

Donovan, John,
Sub-Foreman,
Pressed Steel Car Co.,
806 Frank St.,
McKees Rocks, Pa.

Donovan, J. J.,
Gen. Fore., P. & L. E. R. R.,
426 Jones St.,
Bellevernon, Pa.

Down, S. G.,
Vice President, Westinghouse
Airbrake Co.,
Wilmerding, Pa.

Downes, James R.,
Chief of Frt. Transp'n.,
Penna. R. R. Co.,
Broad Street Station,
Philadelphia, Pa.

Downes, M. S.,
Asst. to Gen. Mgr., Ry Div.,
Timken Roller Bearing Co.,
Canton, Ohio

Doyle, William E.,
Asst. C. C. to M. C. B.,
P. & L. E. R.R.,
912 Liberty St.,
McKees Rocks, Pa.

Draper, Thos.,
President, Draper Mfg. Co.,
Port Huron, Mich.

Duchene, L. P.,
Trainmasters' Clerk,
Aliquippa & Southern R. R.,
1906 Main St.,
Aliquippa, Pa.

Duff, Samuel E.,
Consulting Engineer,
712 Magee Bldg.,
Pittsburgh, Pa.

Dunbar, Chas. I.,
Conductor,
P. H. B. & N. C. Ry.,
514 So. Washington St.,
Butler, Pa.

Dunbar, Harold F.,
Sales Rep., The McConway
& Torley Co.,
48th St. & A. V. R. R.,
Pittsburgh, Pa.

Dunlap, Robert L., Jr.,
Terminal Foreman,
Montour Railroad Co.,
Willock, Pa.

Dunmire, J. O.,
Engine House Foreman,
B. & O. R. R.,
Box 224,
Foxburg, Pa.

Dunn, Samuel O.,
Editor, Railway Age Gazette,
105 W. Adams St.,
Chicago, Ill

Durkin, Jas. E.,
General Foundry Foreman,
Ft. Pitt Mall. Iron Co.,
37 Conway St.,
McKees Rocks, Pa.

Duryea, O. C.,
President,
O. C. Duryea Corp'n.,
Nixon Hotel,
Butler, Pa.

Eagan, D. F.,
Asst. T. M. & Div. Opr.,
Penna. System,
39 Mt. Oliver St.,
Pittsburgh, Pa.

Eagan, J. T.,
R. F. of E., B. R. & P. Ry.,
208 W. Scribner Ave.,
Du Bois, Pa.

Earley, J. T.,
Ind. Sales Rep.,
O'Brien Varnish Co.,
Box 114,
Saxonburg, Pa.

Ebenhack, Omar C.,
Traffic Department,
Pittsburgh Coal Co.,
P. O. Box 64,
Pittsburgh, Pa.

Eckerson, H. D.,
273 Baywood Ave.,
S. H. B., Pittsburgh, Pa.

Eckes, Joseph M.,
Salesman,
Railway Products Co.,
First Natl. Bank Bldg.,
Pittsburgh, Pa.

Eder, F. J.,
Clerk,
Aliquippa & Southern R. R.,
811 Sixteenth St.,
Aliquippa, Pa.

Edgin, Geo. A.,
Asst. General Manager,
The Duff-Norton Mfg. Co.,
P. O. Box 555,
Pittsburgh, Pa.

Edwards, Clifton H.,
Storekeeper, Ft. Pitt
Malleable Iron Co.,
325 Singer Ave.,
McKees Rocks, Pa.

Eichenlaub, W. C.,
Sales Manager,
Pittsburgh Steel Foundry
Corp.,
Glassport, Pa.

Eichorn, T. F.,
Asst. Supt. of Production,
Westinghouse Air Brake Co.,
400 Caldwell Ave.,
Wilmerding, Pa.

Eisenbeis, W. H.,
Asst. Sales Manager,
Union Steel Casting Co.,
62nd and Butler Sts.,
Pittsburgh, Pa.

Elicker, Howard,
Blacksmith,
Union Railroad,
Box 46,
North Bessemer, Pa.

Elliott, M. W.,
Manager, Consumers Oil Co.,
1016 Constance St.,
N. S., Pittsburgh, Pa.

Ellis, A. R.,
Gen. Mgr., Pitts. Test. Lab.,
Stevenson & Locust Sts.,
Pittsburgh, Pa.

Ellis, C. B.,
Gen. Traffic Manager,
Gulf Companies,
1466 Frick Annex,
Pittsburgh, Pa.

Emerick, J. B.,
Salesman,
Garlock Packing Co.,
Chamber of Commerce Bldg.,
Pittsburgh, Pa.

Emery, C. W.,
Trainmaster,
Mon. Con. R. R. Co.,
313 Spokane Ave.,
Carrick, Pgh., Pa.

Emery, E.,
Railway Supplies,
304 Oliver Bldg.,
Pittsburgh, Pa.

En Dean, J. F.,
Inspecting Engineer,
P. & L. E. R. R.,
436 Edgemont St.,
Knoxville,
Pittsburgh, Pa.

Endsley, Louis E., Prof.,
Consulting Engr.,
516 East End Ave.,
Pittsburgh, Pa.

England, Alexander,
Chief Engineer,
W. A. B. Co.,
428 Biddle Ave.,
Wilkinsburg, Pa.

Evans, David F.,
Representative,
The Duff Mfg. Co.,
N. S., Pittsburgh, Pa.

Evans, E.,
Locomotive Engineer,
Union Railroad,
Fourth St.,
Braddock, Pa.

Everstine, A. Perry,
Accounting Engineer,
P. & W. Va. Ry.,
Wabash Bldg.,
Pittsburgh, Pa.

Faessel, Joseph, Jr.,
Clerk, B. R. & P. Ry.,
1230 Sheffield St.,
N. S., Pittsburgh, Pa.

Fagan, R.,
Chief Clerk,
Glassport Car Shop,
P. and L. E. R. R.,
801 Indiana Ave.,
Glassport, Pa.

Faix, Joseph,
P. W. I. F., P. & L. E. R. R.,
639 Michigan Ave.,
Glassport, Pa.

Falkner, Andrew J.,
Interchange Clerk,
B. & O. R. R.,
4014 Coleman St.,
Pittsburgh, Pa.

Fallon, James J., Jr.,
Supt. Shipping So. Side Wks.,
Jones & Laughlin Steel
Corporation,
101 Poplar St.,
Carrick, Pittsburgh, Pa.

Fallon, M. L.,
Asst. Roadmaster,
B. R. & P. Ry.,
Punxsutawney, Pa.

Farfan, Robert F.,
Mechanical Engineer,
Westinghouse E. & M. Co.,
716 Lamar St.,
Wilkinsburg, Pa.

Farmer, C. C.,
Director of Engineering,
W. A. B. Co.,
Wilmerding, Pa.

Farrell, G. R.,
Representative,
Nat'l. Mall. & Steel Cstgs. Co.,
10600 Quincey Ave.,
Cleveland, Ohio.

Farrington, Robert J.,
General Foreman,
P. & L. E. R. R.,
1318 Vine St.,
McKees Rocks, Pa.

Fay, Frank L., Hon.,
Chairman of the Board,
Greenville Steel Car Co.,
Greenville, Pa.

Fendner, W. J.,
Mechanical Engineer,
Schaefer Equipment Co.,
Koppers Bldg.,
Pittsburgh, Pa.

Fenton, H. H.,
Supt. Instruction,
Pittsburgh Railways,
435 Sixth Ave.,
Pittsburgh, Pa.

Ferguson, O. G.,
W. H. Wood Co.,
3454 Forbes St.,
Pittsburgh, Pa.

Ferguson, R. B.,
Asst. Yardmaster,
Mon. Con. R. R. Co.,
3022 Elroy Ave.,
Brentwood,
Pittsburgh, Pa.

Ferrick, John T.,
Freight Cashier,
P. & L. E. R. R.,
Terminal Annex,
Pittsburgh, Pa.

Fettinger, H. O.,
Rep., Ashton Valve Co.,
126 Liberty St.,
New York, N. Y.

Fieldson, P. H.,
Asst. Master Car Builder,
P. & L. E. R. R.,
810 Wood St.,
Coraopolis, Pa.

Fike, Jas. W.,
Assistant Freight Trainmaster,
Penna. System,
1224 Daugherty Place,
Canton, Ohio.

Filson, Harry T.,
Engine Dispatcher,
Montour Railroad,
George Street,
Coraopolis, Pa.

Finegan, Leo
Superintendent,
Flannery Bolt Co.,
Keystone Athletic Club,
Pittsburgh, Pa.

Fink, Peter J.,
General Car Foreman,
P. & L. E. R. R.,
Woodlawn Car Shop,
Aliquippa, Pa.

Fischer, G. E.,
Clerk, Union Railroad,
2202 Hampton St.,
Swissvale, Pa.

Fisher, Earl H.,
Sales Engineer,
The Wine Rwy. Appliance Co.
Toledo, Ohio.

Fisher, E. M.,
Asst. R. F. of E.,
Penna. Railroad System,
909 E. Washington St.,
New Castle, Pa.

Fisher, G. Malcolm,
Blacksmith, Union R. R.,
Unity Center Road,
Unity, Pa.

Fisher, Harry G.,
Clerk, B. R. & P. Ry.,
2455 Wenzel Ave.,
Pittsburgh, Pa.

Fisher, John J.,
Trav. Car Insp'r., Union R. R.,
East Pittsburgh, Pa.

Fitzgerald, T.,
Vice President,
Pittsburgh Railways Co.,
435 Sixth Ave.,
Pittsburgh, Pa.

Fitzpatrick, T. R.,
Coal Traffic Manager,
P. & L. E. R. R.,
212 Lexington Ave.,
Aspinwall, Pa.

Fitsimmons, E. S.,
Mgr. Sales,
Flannery Bolt Co.,
Flannery Bldg.,
Pittsburgh, Pa.

Flaherty, P. J.,
Pres. and General Mgr.,
Johnson Bronze Co.,
So. Mill Street,
New Castle, Pa.

Flannery, J. Rogers,
Vice Pres. Flannery Bolt Co.,
Flannery Bldg.,
Pittsburgh, Pa.

Fleckenstein, August,
P. W. Insp'r., P. & L. E. R. R.,
1108 Crucible St., 20th Wd.,
Pittsburgh, Pa.

Fletcher, Albert,
Gang Fore., Car Dept.,
Union Railroad Co.,
454 Second St.,
Pitcairn, Pa.

Flinn, R. H.,
Gen. Supt. Motive Power,
Penna. Railroad,
Pittsburgh, Pa.

Flynn, E. E.,
Publicity Dept.,
Westinghouse Air Brake Co.,
353 Marguerite Ave.,
Wilmerding, Pa.

Follett, W. F.,
Asst. Supt.
Aliquippa & Southern R. R.,
106 King St.,
Aliquippa, Pa.

Foote, Frederick D.,
President,
Greenville Steel Car Co.,
Greenville, Pa.

Forney, H. L.,
Master Carpenter,
B. & O. R. R.,
582 South Aiken Ave.,
Pittsburgh, Pa.

Forrest, C. H.,
Foreman, P. & L. E. R. R.,
851 Sixth Ave.,
Coraopolis, Pa.

Foster, F. L.,
Asst. Supt. Frt. Transportation,
P. & L. E. R. R.,
Pittsburgh, Pa.

Fowler, W. E.,
Gen. Superintendent,
Montour Railroad,
Coraopolis, Pa.

Fowler, W. E., Jr.,
3305 Meadowcroft Ave.,
South Hills Branch,
Pittsburgh, Pa.

Francis, G. E.,
General Foreman,
P. R. R. Co.,
E. & M., Juniata Shops,
Altoona, Pa.

Frauenheim, A. M.,
Vice President,
Standard Auto-Tite Joint Co.,
916 Forbes St.,
Pittsburgh, Pa.

Frauenheim, H. T.,
524 Fourth Ave.,
Pittsburgh, Pa.

Freshwater, F. H.,
Sales Agent,
Pressed Steel Car Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Fritz, A. A.,
Clerk, Mon. Conn. R. R.,
133 Stewart Ave.,
Mt. Oliver Station,
Pittsburgh, Pa.

Fults, John H.,
Clerk,
Union National Bank,
Wood Street,
Pittsburgh, Pa.

Funfer, James,
Gang Fore., Car Dept.,
Union Railroad Co.,
R. F. D. No. 1,
Turtle Creek, Pa.

Furch, George J.,
Gang Fore., Penna. System,
3610 Wickshire St.,
N. S., Pittsburgh, Pa.

Gable, Harry R.,
Time Checker,
Union Railroad,
661 Sixth St.,
Pitcairn, Pa.

Gabriel, E. J.,
Asst. Round House Foreman,
Union Railroad,
Church Hill Rd., Box 513,
Turtle Creek, Pa.

Gaffney, Thomas H.,
Roadmaster,
Montour Railroad,
State Ave.,
Coraopolis, Pa.

Gallinger, Geo. A.,
Gen. Manager, Pneumatic
Sales, Ingersoll-Rand Co.,
11 Broadway,
New York, N. Y.

Gallowich, Louis,
Car Insp'r., Penna System,
3 Matson St.,
N. S., Pittsburgh, Pa.

Gammiere, E. J.,
Fore., Core Dept.,
Ft. Pitt Malleable Iron Co.,
107 Jane St.,
McKees Rocks, Pa.

Garant, E. J.,
Sales Manager,
Buckeye Chemical Co.,
1351 Porter St.,
Detroit, Mich.

Gardner, George R.,
Rate Clerk, Pgh. Coal Co.,
1260 Hillsdale Ave.,
Dormont, Pa.

Gardner, K. C.,
Vice President,
Greenville Steel Car Co.,
Greenville, Pa.

Garland, W. L.,
V. P., Safety Car Htg. &
Ltg. Co.,
1738 Commercial Trust bldg.
Philadelphia, Pa.

Garlow, Andrew,
Airbrake Inspector,
Union Railroad,
North Bessemer, Pa.

Gates, C. F.,
Asst. Chief Clerk,
P. & L. E. R. R.,
Pittsburgh, Pa.

Geddes, James R.,
General Supt.,
Mon. Con. R. R. Co.,
3540 Second Ave.,
Pittsburgh, Pa.

Geisler, Jos. J.,
Mech, Engineer,
Ft. Pitt Mall. Iron Co.,
1023 Chartiers Ave.,
McKees Rocks, Pa.

Gellatly, Wm. R.,
Vice President,
Rees Manufacturing Corp.,
Thomas Boulevard,
Pittsburgh, Pa.

Geyer, Harry M.,
Asst. Trainmaster,
Mon. Con. R. R. Co.,
166 Longuevue Drive,
Mt. Lebanon, Pa.

Gibson, A. B.,
Renewal Parts Sec. Head,
Westinghouse Elec. &
Mfg. Co.,
East Pittsburgh, Pa.

Gibson, D. W.,
Superintendent,
Railway Express Agency,
926 Penn Ave.,
Pittsburgh, Pa.

Gilg, Henry F.,
Railway Supplies,
1426 Orchlee St.,
N. S., Pittsburgh, Pa.

Gillespie, John M.,
Vice-Pres., Lockhart Iron
& Steel Company,
P. O. Box 1243,
Pittsburgh, Pa.

Gillespie, William M.,
Attorney,
B. R. & P. Ry.,
West Mahoning St.,
Punxsutawney, Pa.

Givler, Hugh C.,
Machinist,
Penna, R. R. System,
528 Fifth St.,
Pitcairn, Pa.

Glaser, J. P.,
Auditor Disbursements,
P. & L. E. R. R.,
909 Bellaire Avenue,
Pittsburgh, Pa.

Glass, H. M.,
Foreman, P. R. R.,
Emporium, Pa.

Glenn, J. H.,
R. F. of E. P. & W. Va. Ry.,
20 Obey St.,
Pittsburgh, Pa.

Glessner, Geo. P.
Wrecker Engineer,
Union Railroad,
R. D. No. 1,
Turtle Creek, Pa.

Gochnour, J. P.,
Air Brake Instr.,
P. R. R. System,
Ligonier, Pa.

Goda, P. H.,
Asst. Gen. Fore., P. R. R.,
P. O. Box 73,
Pitcairn, Pa.

Godfrey, C. H.,
Dist. Service Engr.,
Franklin Rwy. Supply Co.,
1086 Morningside Ave.,
Schnectady, N. Y.

Goff, J. P.,
Asst. T. M., P. & L. E. R. R.,
615 Montour St.,
Coraopolis, Pa.

Goodman, O. F.,
Sales Engineer,
Worthington Pump &
Machinery Corp.,
407 Oliver Bldg.,
Pittsburgh, Pa.

Gorby, Frank E.,
Supt., Union R. R.,
East Pittsburgh, Pa.

Gordon, George A.,
General Foreman,
P. & W. Va. Ry.,
56 Oakwood Road,
Crafton, Pittsburgh, Pa.

Gordon, George L.,
General Mgr. of Sales,
Lukens Steel Co.,
Coatesville, Pa.

Gorman, Charles.
District Manager,
The Garland Co.,
227 Chemung St.,
N. S., Pittsburgh, Pa.

Gorman, J. C.,
Supt., McK. Con. R. R. Co.,
1221 Fremont Ave.,
McKeesport, Pa.

Gorman, P. F.,
Passenger Conductor,
B, R. & P. Ry.,
139 Greenfield St.,
Buffalo, N. Y.

Goron, F. W.,
Asst. Gen. Foreman,
P. & L. E. R. R.,
874 Railroad St.,
McKees Rocks, Pa.

Gove, William G.,
Superintendent of Equip't.,
Brooklyn-Manhattan Transit Lines,
Administration Bldg.,
Gravesend Ave.,
Brooklyn, N. Y.

Graham, A. C.,
Traffic Manager,
Youngstown Sheet and Tube
Company,
Stambaugh Bldg.,
Youngstown, Ohio

Graham, Chas J.,
Vice President,
Pgh. Screw & Bolt Corp.,
2613 Grant Bldg.,
Pittsburgh, Pa.

Graham, Harry C.,
Pittsburgh Screw and Bolt
Corporation,
P. O. Box 72,
Pittsburgh, Pa.

Graham, James,
Inspector,
P. R. R. System,
806 Southern Ave.,
Mt. Washington Sta.,
Pittsburgh, Pa.

Gratton, James,
Master Painter,
B. R. & P. Ry.,
119 Stockdale St.,
DuBois, Pa.

Gray, C. B.,
M. M., Penna. System,
1155 Liberty Ave.,
Pittsburgh, Pa.

Gray, Guy M.,
S. M. P.,
B. & L. E. R. R. Co.,
Greenville, Pa.

Green, E. C.,
R. F. of E.,
B. R. & P. Ry.,
418 E. Mahoning St.,
Punxsutawney, Pa.

Greene, W. F.,
Asst. Engr., M. of W.,
Penna System,
314 Penna. Station,
Pittsburgh Pa

Grewe, H. F.,
S. M. P., A. C. & Y. Ry.,
1531 Goodyear Ave.
Akron, Ohio

Grieve, Robert E.,
Passenger Train Master,
P. R. R.,
1010 Wallace Ave.,
Wilkinsburg, Pa.

Griffith, F. A.,
District Manager,
Garlock Packing Co.,
Chamber of Commerce Bldg.,
Pittsburgh, Pa.

Grimshaw, F. G.,
Works Mgr., P. R. R. Sys.,
Altoona, Pa.

Groves, John Q.,
President,
Deposit National Bank,
DuBois, Pa.

Gunnison, Walter L.,
Representative,
Enterprise Railway
Equipment Co.,
Rookery Building,
Chicago, Ill.

Guy, Frank E.
Eastern Traffic Mgr.,
Universal Portland Cement Co.,
Frick Bldg.,
Pittsburgh, Pa.

Guy, W. S.,
Traffic Manager,
Carnegie Steel Co.,
812 Carnegie Bldg.,
Pittsburgh, Pa.

Gwaltney, R. H.,
Vice President,
The Symington Co.,
250 Park Ave.,
New York, N. Y.

Hackett, C. M.,
Boiler Maker Fore.,
Penna. R. R.,
616 Fifth St.,
Ookmont, Pa.

Hale, Chas. E.,
Mgr. Pgh. Office,
Baldwin Loco. Works,
375 Union Trust Bldg.,
Pittsburgh, Pa.

Hale, Otis R.,
Dist. Sales Mgr.,
American Loco. Co.,
617 Farmers Bank Bldg.,
Pittsburgh, Pa.

Hall, Charles B.,
Supt. Coal Docks,
Union Railroad Co.,
1600 Vermont Ave.,
McKeesport, Pa.

Hall, Chester C.,
Clerk,
Rieck-McJunkin Dairy Co.,
4119 Millington Road,
Pittsburgh, Pa.

Haller, C. T.,
President,
Colonial Supply Co.,
217 Water St.,
Pittsburgh, Pa.

Haller, Jacob,
Asst. Fore., Wheel and Axle
Dept., Pressed Steel Car
Company,
1808 Jane St.,
S. S., Pittsburgh, Pa.

Haller, Nelson M.,
Sup'r. Scrap & Reclamation,
P. & L. E. E. R. R.,
5853 Aylesboro Ave.,
Pittsburgh, Pa.

Hamilton, Wm.,
Mgr., Railway Sales Dept.,
The Ferbert Shorndorfer Co.,
P. O Box 5077,
East Liberty Sta.,
Pittsburgh, Pa.

Hamilton, W. H.,
Supt. Roadway & Structures.
Montour Railroad,
Coraopolis, Pa.

Hammond, Harry D.,
Vice President,
American Steel Foundries,
410 N. Michigan Ave.,
Chicago, Ill.

Hammond, H. S.,
Sales Agent,
Pressed Steel Car Co.,
55 Broad St.,
New York, N. Y.

Hancock, Milton L.,
Office Engineer,
Westinghouse Air Brake Co.,
1226 McClure Ave.,
East McKeesport, Pa.

Hankins, F. W.,
Chief of Motive Power,
Pennsylvania Railroad,
Broad Street Station,
Philadelphia, Pa.

Hanna, R. B.,
C. C. to Superintendent,
P. & L. E. R. R.,
132 P.&L.E. Annex Bldg.,
Pittsburgh, Pa.

Hansen, J. M.,
Chairman of the Board,
Standard Steel Car Co.,
Frick Bldg.,
Pittsburgh, Pa.

Hansen, Wm. C.,
Sales Engr., A. Stucki Co.,
419 Oliver Bldg.,
Pittsburgh, Pa.

Harbaugh, Chas. P.,
Wreck Master,
Union Railroad,
East Pittsburgh, Pa.

Harger, E. S.,
Gen. Fore., P. & L. E. R. R.,
1455 Myrtle Ave.,
New Brighton, Pa.

Harkness, W. S.,
Foreman, Penna. System,
511 Second St.,
Pitcairn, Pa.

Harper, A. M.,
Mgr. of Sales,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Harper, G. C.,
General Supt.,
Montour Railroad,
State Ave.,
Coraopolis, Pa.

Harris, Francis C.,
Yard Clerk,
Carnegie Steel Co.,
1118 Franklin Ave.,
North Braddock, Pa.

Harris, J. P.,
C. C., to Division Engineer,
B. & O. R. R. Co.,
139 Poplar Drive,
South Hills Sta.,
Pittsburgh, Pa.

Harter, Arnold,
Ass't Fore., W. A. B. Co.,
353 Marguerite Ave.,
Wilmerding, Pa.

Hartsuff, O. J. H.,
Gen. Supt., Carnegie Stl. Co.,
Edgar Thomson Works,
Braddock, Pa.

Harvat, Frank V.,
Airbrake Inspector,
Union Railroad,
R. D. 1—Box 95,
Turtle Creek, Pa.

Haskell, B.,
Mechanical Engineer,
Box 522,
Franklin, Pa.

Hastings, Walter S.,
R. F. of E.,
Aliquippa & Southern R. R.,
Aliquippa, Pa.

Hatcher, J. J.,
Power Plant Foreman,
P. R. R. System,
313 Murdock Ave.,
Mingo Juncton, Ohio.

Hayden, William F.,
,Asst. Baggage Agent,
P. & L. E. R. R.,
P. & L. E. Terminal,
Pittsburgh, Pa.

Hayes, George,
Yardmaster,
Aliquippa & Southern R. R.,
1809 Irwin St.,
Aliquippa, Pa.

Hayes, George W.,
Air Brake Foreman,
P. & L. E. R. R.,
1225 Vance Ave.,
Coraopolis, Pa.

Hayes, R. F.,
Adams & Westlake Co.,
50 Church St.,
New York, N. Y.

Heckman, C. J.,
Draftsman,
Spang, Chalfant Co.,
129 Sixth St.,
Aspinwall, Pa.

Heffelfinger, A. E.,
Sales Manager,
The Symington Co.,
250 Park Ave..
New York City

Heinlein, Geo. J.,
Gang Fore., Penna. System,
220 Shaler St.,
Mt. Washington Sta.,
Pittsburgh, Pa.

Hektner, Joel,
Asst. Engr., Ry. Division,
Timken Roller Bearing Co.,
Canton, Ohio.

Hench, Norman M.,
Sales Manager,
Illinois Steel Co.,
Room 1602,
208 S. La Salle St.,
Chicago, Ill.

Henry, C. L.,
Ass't. M. M., Penna. R. R.,
Mingo Junction, Ohio.

Henry, Frank P.,
General Foreman,
Carnegie Steel Co.,
36 Danners Ave.,
Ingram, Pa.

Hepplewhite, M. R.,
Dist. Passenger Agent,
P. & L. E. R. R. Co.,
6022 Jackson St.,
E. E., Pittsburgh, Pa.

Herald, M. A.,
President, United Car &
Equipment Company,
Westinghouse Bldg.,
Pittsburgh, Pa.

Herlehy, David T.,
P. W. I. F., P. & L. E. R. R.,
Ohio Avenue,
Glassport, Pa.

Herr, R. D.,
Interior Lightning Engr.,
Westinghouse E. & M. Co.,
Chamber of Commerce
Bldg.,
Pittsburgh, Pa.

Herrick, Andrew S.,
Foreman,
Pressed Steel Car Co.,
112 Ella St.,
McKees Rocks, Pa.

Herrold, A. E.,
M. M. & M. C. B.,
Mon. Conn. R. R.,
3915 Winterburn Ave.,
Pittsburgh, Pa.

Hershey, Quincy W.,
Supervisor of Maintenance
Sales, Westinghouse
E. & M. Co.,
7527 Rosemary Road,
Pittsburgh, Pa.

Hershey, Walter,
Clerk, Car Foreman's Office,
Union Railroad Co.,
R. F. D., No. 1,
Wilkinsburg, Pa.

Hervy, R. S.,
Auditor Freight Accounts,
P. & L. E. R. R,
722 Main Street,
Coraopolis, Pa.

Herzog, Charles C.,
Chief Clerk,
Penna. Railroad,
118 Second St.,
Aspinwall, Pa.

Hester, L. A.,
Sales Engr., Heavy Trac.,
Westinghouse Elec. &
Mfg. Co.,
East Pittsburgh, Pa.

Hettler, R. C.,
Foreman,
Penna. R. R. System,
1722 Brighton Road,
N. S., Pittsburgh, Pa.

Hewlett, H. D.,
Foreman,
P. & L. E. R. R.,
613 Island Ave.,
McKees Rocks, Pa.

Hickling, F. G.,
Mgr. Transportation Div.,
Westinghouse Elec. &
Mfg. Co.,
Grant Bldg.,
Pittsburgh, Pa.

Hill, R. W.,
Chief Account Clerk,
Pennsylvania R. R. System,
249 Cornell Ave.,
West View, Pa.

Hill, W. D.,
Auditor,
Monongahela Rwy. Co.,
Century Bldg.,
Pittsburgh, Pa.

Hilstrom, Anton V.,
Piece Work Inspector,
P. & L. E. R. R.,
3066 Glen Mawr. Ave.,
Pittsburgh, No. 4, Pa.

Hindman, S. M.,
Schaefer Equipment Co.,
Koppers Bldg.,
Pittsburgh, Pa.

Hiner, L. D.,
Sales Agent,
Railway Steel Spring Co.,
617 Farmers Bank Bldg.,
Pittsburgh, Pa.

Hodge, Edwin, Jr.,
President,
Pittsburgh Knife &
Forge Co.,
Drawer "C,"
Coraopolis, Pa.

Hoffstot, H. P.,
Vice President,
Pressed Steel Car Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Hogg, Francis,
Draftsman,
General Electric Co.,
2326 Station Road,
Wesleyville, Pa

Holiday, Harry,
Genearl Superintendent,
The American Rolling Mill
Company,
Butler, Pa.

Holleran, Thomas J.,
Engineer,
Monongahela Connecting
R. R.,
251 Ninth Ave.,
West Homestead, Pa.

Hollingsworth, C. N.,
C. C. to Chitf Engr.,
P. R. R. System,
1117 Pennsylvania Sta.,
Pittsburgh, Pa.

Hollis, H. E.,
Secretary-Treasurer,
Pittsburgh Incinerator Co.,
213 Grandview Ave.,
Mt. Washington Station,
Pittsburgh, Pa.

Holmes, E. H.,
Sales Dept.,
Ft. Pitt Malleable Iron Co.,
3662 Middletown Road,
McKees Rocks, Pa.

Holohan, S. V.,
Passenger Conductor,
B. R. & P. Ry.,
364 Norwood Ave.,
Buffalo, N. Y.

Honsberger, G. W.,
Salesman,
Westinghouse E. & M. Co.,
Grant Bldg.,
Pittsburgh, Pa

Hood, D. G.,
Asst. to Traffic Manager,
P. & L. E. R. R. Co.,
Pittsburgh, Pa.

Hood, J. M.,
Chemist, Ft. Pitt Malleable
Iron Co.,
419 Russellwood Ave.,
McKees Rocks, Pa.

Hoover, Jacob W.,
Chf. Traffic Dispatcher,
Carnegie Steel Co.,
816 Carnegie Bldg.,
Pittsburgh, Pa.

Hoover, Robert C.,
Machinist, Penna. System,
Pitcairn, Pa.

Hopkins, G. M.,
Foreman, Boiler Shop,
Montour Railroad,
715 Idlewood Ave.,
East Carnegie, Pa.

Horan, John A.,
Gang Fore., Penna. System,
Pitcairn Car Shops,
Pitcairn, Pa.

Horner, William,
General Yardmaster,
Mon. Con. R. R. Co.,
3526 Beechwood Blvd.,
Pittsburgh, Pt.

Horwick, George M.,
Car Distributor,
B. R. & P. Ry.,
3 Jefferson St.,
Punxsutawney, Pa.

Householder, J. A.,
Foreman,
Westinghouse Air Brake Co.,
Madison Ave.,
Irwin, Pa.,

Howard, L. F.,
Chief Engineer,
Union Switch & Signal Co.,
Swissvale, Pa.

Howe, Harry,
Engineer of Rwy. Equip't.,
Manganese Steel Forge Co.,
Richmond St. & Erie Ave.,
Philadelphia, Pa.

Howe, H. W.
Yard Master,
Aliquippa & Southern R. R.,
573 Remo St.,
Rochester, Pa.

Howells, Wyman,
Dist. Sales Representative,
Reading Iron Co.,
First Nat'l. Bank Bldg.,
Pittsburgh, Pa.

Huber, H. G.,
Master Mechanic, P. R. R.,
Fayette Title & Tr. Bldg.,
Uniontown, Pa.

Heusner, R. D.,
Gen'l. Coal Freight Agent,
Reading Company,
Reading Terminal,
Philadelphia, Pa.

Hughes, J. E.,
Supt., P. & L. E. R. R.,
134 P. & L. E. Term'l. Bldg.,
Pittsburgh, Pa.

Humphrey, A. L.,
President,
Westinghouse Air Brake Co.
Wilmerding, Pa.

Hunt, Lawrence,
Gen. Fore., Tank Car Dept.,
Pressed Steel Car Co.,
272 Balph Ave.,
Bellevue, Pa.

Hunter, Bernard E.,
Westinghouse Air Brake Co.,
827 Railway Exchange Bldg.,
Chicago, Ill.

Huntington, H. E.,
Asst. Traffic Manager,
B. R. & P. Ry.
155 Main St., W.,
Rochester, N. Y.

Hussong, Albert C.,
Asst. G. F. Pass. Car Insp.,
P. R. R. Co.,
Pass'r. Car Yards,
232 Chadwick St.,
Sewickley, Pa.

Hykes, W. H.,
Assistant Trainmaster,
Penna. R. R. Co.,
526 Sixth St.,
Oakmont, Pa.

Hyndman, F. T.,
3115 Lincoln Blvd.,
Cleveland, Ohio

Inks, S. W.,
General Foreman,
P. & L. E. R. R.
Box 253,
Dawson, Pa.

Irons, L. O.,
Signal Material Supv'r.,
P. & L. E. R. R.,
Beaver Falls, Pa.

Irwin, Robert D.,
Foreman,
Westinghouse Air Brake Co.,
521 Holmes St.,
Wilkinsburg, Pa.

Jack, Arthur C.,
Engineer, Track Appliances,
Carnegie Steel Co.,
Carnegie Budg.,
Pittsburgh, Pa.

Jack, R. Ralph,
Asst. Paymaster,
Union Railroad,
54 Haslett Ave.,
Lincoln Place, Pa.

Jacobs, M. H.,
G. F. A.,
Western Maryland R. R.,
408 Park Building,
Pittsburgh, Pa.

Jacobs, William H.,
Crew Dispatcher,
P. & L. E. R. R.,
Dickerson Run, Pa.

Jahnke, Karl W.,
Piece-work Inspector,
P. & L. E. R. R. Co.,
238 Singer Ave.,
McKees Rocks, Pa.

Jenkner, Oscar,
G. Y. M., Union R. R.,
503 Hunter St.,
Turtle Creek, Pa.

Johnson, A. B.,
Sales Engr., Standard Steel
Car Company,
1120 Frick Bldg.,
Pittsburgh, Pa.

Johnson, E. A.,
15 N. Euclid Ave.,
Bellevue, Pittsburgh, Pa.

Johnson, George T.,
Vice President, The
Buckeye Steel Castings Co.,
South Parsons Ave.,
Columbus, Ohio

Johnson, I. S.,
Resident Material Inspector,
Penna. System,
Room 402-1013 Penn Ave.,
Pittsburgh, Pa.

Johnson, J. W.,
City Mgr., Amer.
Rwy. Express Co.,
926 Penn Ave.,
Pittsburgh, Pt.

Johnson, Nelson E.,
Machinist, P. & L. E. R. R.,
68 Dunn St.,
McKees Rocks, Pa

Johnson, Robert S.,
Engr., P. & W. Va. Ry.,
67 Water St.,
Pittsburgh, Pa.

Johnson, Wm. M.,
Gen. Superintendent,
B. & L. E. R. R.,
Greenville, Pa.

Johnston, A. L.,
Car Inspector,
Union Railroad,
Box 188,
Unity, Pa.

Johnston, E. E.,
Engineer,
Westinghouse Electric &
Manufacturing Co.,
111 Seventh St.,
Turtle Creek, Pa.

Johnston, Geo. E.,
Clerk, Union Railroad,
26 Hill St.,
Hays, Pa.

Johnston, I. C.,
Yard Master,
Union R. R. Co.,
Box No. 3,
N. Bessemer, Pa.

Johnston, W. A.,
Gang Fore., Penna. System,
368 Second St.,
Pitcairn, Pa.

Jones, Louis E.,
Department Manager,
American Steel Foundries,
North Wrigley Bldg.,
Chicago, Ill.

Jones, V. J.,
Representative,
James B. Sipe & Co.,
Chamber of Commerce Building,
Pittsburgh, Pa.

Jones, W. F.,
Purchasing Agent,
Dining Service,
New York Central Lines,
466 Lexington Ave.,
New York, N. Y.

Jones, William M..
Clerk, Union Railroad.
5020 Glenwood Ave..
Hazelwood Sta.,
Pittsburgh, Pa.

Jungbluth, A.,
Superintendent,
Peoples East End Real Estate Co.,
6616 Jackson St.,
E. E., Pittsburgh, Pa.

Justice, R. W.,
Distributor,
E. F. Houghton & Co.,
610 Washington Road,
South Hills Branch,
Pittsburgh, Pa.

Kalik, John R.,
Air Brake Inspector,
Union Railroad,
R. D. 1,
Turtle Creek, Pa.

Kamerer, R. W.,
Terminal Agent,
P. & L. E. R. R.,
Terminal Annex Bldg.,
Pittsburgh, Pa.

Karns, C. A.,
Sales Department,
Edgewater Steel Co.,
P. O. Box 249,
Pittsburgh, Pa.

Karnes, W. T..
General Foreman,
P. & L. E. R. R.,
330 Ohio Ave.,
Glassport, Pa.

Kaup, Harry E.,
Gen. Supt.,
Pressed Steel Car Co..
McKees Rocks, Pa.

Kavanagh, D.,
Storekeeper,
Union Railroad,
East Pittsburgh, Pa.

Kearney, J. W.,
Mgr. of Sales, Canton Car Co.,
Perry Payne Bldg.,
Cleveland, Ohio.

Keefe, Edward A.,
Coal Billing Agent,
B. & O. R. R.,
112 Grandview Ave.,
Mt. Washington,
Pittsburgh, Pa.

Keenoy, R. P.,
V. P. & G. S., D. S. R. R.,
902 Jancey St.,
E. E., Pittsburgh, Pa.

Kelin, H. S.,
Draftsman, Union R. R., Co.,
R. F. D. 4, Box 208-L,
Millvale,
Pittsburgh, Pa.

Kellenberger, K. E.,
Publicity Manager,
Union Switch & Signal Co.,
P. O. Box 127,
Wilkinsburg, Pa.

Keller, D. P.,
Conductor,
P. & W. Va. Ry.,
524 Forest Ave.,
Carnegie, Pa.

Kelley, Henry D.,
District Manager,
Metal & Thermit Corp.,
1514 Fayette St.,
N. S., Pittsburgh, Pa.

Kelley, H. W.,
Locomotive Inspector,
Penna. R. R. Co.,
5840 Center Ave.,
Pittsburgh, Pa.

Kelly, H. B.,
Gen. R. F. of E.,
P. & L. E. R. R.,
821 Davis Ave.,
McKees Rocks, Pa.

Kelley, J. B.,
Bradfordwoods, Pa.

Kelly, Harry S.,
146 State St.,
McKees Rocks, Pa.

Kelly, J. P.,
Asst. Superintendent,
P. & L. E. R. R.,
922 School St.,
Coraopolis, Pa.

Kelly, J. W.,
Boiler Tube Expert,
National Tube Co.,
515 N. Grove Ave.,
Oak Park, Ill.

Kelly, Leo F.,
Sales Representative,
Pgh. Screw & Bolt Corp.,
3913 California Ave.,
N. S., Pittsburgh, Pa.

Kelly, Leo J.,
Superintendent,
Ft. Pitt Mall. Iron Co.,
3036 Bergman St,
Pittsburgh, Pa.

Kempton, J. W.,
Gen. Sec'y., Y. M. C. A.,
P. & L. E. R. R.,
Newell, **Pa.**

Kennedy, A. R.,
Traffic Manager,
Pittsburgh Steel Co.,
Union Trust Building,
Pittsburgh, Pa.

Kennedy, F. D.,
Supt., Railway Dept.,
Westinghouse Elec. &
Mfg. Co.,
242 Bevington Road,
Wilkinsburg, Pa.

Kennedy, F. J.,
Auditor Pass, Accounts,
P. & L. E. R. R.,
802 Fifth Street,
New Brighton, Pa.

Kennedy, Julian,
Consulting Engineer,
Bessemer Bldg.,
Pittsburgh, Pa.

Kepler, G. W.,
Secretary and Treasurer,
B. & L. E. R. R. Co.,
Union Trust Bldg.,
Pittsburgh, Pa.

Kerby, Frederick,
Asst. to Chief of Motive
Power and Equipment.
B. & O. R. R.,
218 Pennsylvania Ave.,
Cumberland, Md.

Kerr, Clark R.,
Asst. Car Foreman,
Union Railroad Co.,
1109 Wool St.,
Duquesne, Pa.

Kessler, Howard,
R. F. of E., P. & L. E. R. R.,
135 Amelia St.,
McKees Rocks, Pa.

Ketchpel, Paul A.,
Engineer,
Lower Stoker Co.,
932 N. Lincoln Ave.,
N. S., Pittsburgh, Pa.

Ketterer, Frederick P.,
Office Train Master,
P. & L. E. R. R.,
1518 McFarland Road,
Dormont, Pa.

Keys, Arthur H.,
General Car Foreman,
B. & O. R. R.,
2801 Crosby Ave.,
Pittsburgh, Pa.

Kidd, Howard C.,
Professor of Commerce,
University of Pittsburgh,
Pittsburgh, Pa.

Kiefer, Fred,
Pasteurizer,
Rieck-McJunkin Dairy Co.,
4915 Jordon St.,
E. E., Pittsburgh, Pa.

Kight, R.,
Conductor,
Western Maryland Ry. Co.,
Thomas, W. Va.

Kilmer, George L.,
Asst. to President,
Bradford Corporation,
25 West 43rd St.,
New York City

Kimling, Karl,
Asst. Mgr. Central Whse.,
P. & L. E. R. R.,
85 Harwood Street,
Pittsburgh, Pa.

King, C. F., Jr.,
General Engineer,
Westinghouse Elec. &
Mfg. Co.,
East Pittsburgh, Pa.

King, T. C.,
Mgr., R. R. Sales,
Pgh. Knife & Forge Co.,
First Nat'l. Bank Bldg.,
Pittsburgh, Pa.

Kinney, Thomas F.,
Asst. Foreman, Dept. "U,"
Westinghouse Air Brake Co.,
233 Welsh Ave.,
Wilmerding, Pa.

Kirkpatrick, H. F.,
Chief Clerk,
Union Steel Castings Co.,
62nd and Butler Sts.,
Pittsburgh, Pa.

Kirkpatrick, R. L.,
Traction Apparatus Sales,
Westinghouse Elec. &
Mfg. Co.,
East Pittsburgh, Pa.

Kiser, Joseph A., Jr.,
Gang Fore., Car Dept.,
Union Railroad Co.,
R. F. D. No. 1,
Verona, Pa.

Kleber, Charles, J.,
P. W. I.—P. & L. E. R R,
R. F. D., No. 1, Box 104,
McKees Rocks, Pa.

Kleinhans, Harry,
942 Union Trust Bldg.,
Pittsburgh, Pa.

Kleinhans, L.,
District Sales Mgr.,
Industrial Brown Hoist
Corporation,
2401 Koppers Bldg.,
Pittsburgh, Pa.

Kline, I. N.
Foreman,
Westinghouse Airbrake Co.,
510 Grandview Ave.,
East Pittsburgh, Pa.

Knapp, A. D.,
President,
Nicola Lumber Co.,
1410 Farmers Bk. Bldg.,
Pittsburgh, Pa.

Knapp, K. M.,
District Manager,
Universal Steel Co.,
Chamber of Com. Bldg.,
Pittsburgh, Pt.

Knox, Wm. J.,
Mechanical Engineer,
B. R. & P. Ry. Co.,
10 Fourth St.,
DuBois, Pa.

Koch, P. R.,
Station Master,
P. & L. E. R. R.,
Pittsburgh, Pa.

Koehler, Paul A.,
Clerk,
Union Railroad Co.,
739 Glenn St.,
Wilkinsburg, Pa.

Kohl, H. J.,
Gen. Car Fore.,
P. & L. E. R. R.,
1106 Tweed St.,
Pittsburgh, Pa.

Kohute, Hilary Geo.,
Clerk, Union R. R.,
East Pittsburgh, Pa.

Krause, Harry A.,
Gang Fore., Penna. System,
160 Race St.,
Edgewood, Pittsburgh, Pa.

Kromroy, F. R.,
South American Rep.,
Westinghouse Airbrake Co.
c/o G. C. Dehne,
Wilmerding, Pa.

Kroske, J. F.,
Mgr., P. T. Sales, Ingersoll
Rand Co.,
706 Chamber of Commerce
Bldg.,
Pittsburgh, Pa.

Kummer, Jos. H.,
Supt. of Orders,
Fort Pitt Mall. Iron Co.,
209 Greydon Ave.,
McKees Rocks, Pa.

Lackner, R. A.,
V. P., Neely Nut & Bolt Co.,
26 So. 22nd St.,
Pittsburgh, Pa.

Ladd, Geo. T.,
President,
United Engineering & Fdy. Company,
2307 Farmers Bank Bldg.,
Pittsburgh, Pa.

Laird, E. C.,
Editor & Publisher,
The Railroad Herald,
1038 W. Peachtree St., N. W.
Atlanta, Ga.

Laird, Geo. R.,
Clerk, Penna. System,
938 Milton St.,
Wilkinsburg, Pa.

Laird, Joseph,
Trainmasters Clerk,
Aliquippa & Southern R. R.,
529 Sixth Ave.,
Beaver, Pa.

Lally, C. V.,
General Manager of Sales,
Pgh. Steel Products Co.,
605 N. Negley Ave.,
Pittsburgh, Pa.

Lanahan, Frank J.,
President, Fort Pitt
Mall. Iron Co.,
P. O. Box 1054,
Pittsburgh, Pa.

Lanahan, J. S.,
Vice-President. Fort Pitt
Mall. Iron Co.,
127 Elysian Ave.,
Pittsburgh, Pa.

Landgraf, F. K.,
General Supt.,
Flannery Bolt Co.,
118 Crafton Ave.,
Crafton, Pa.

Landis, W. C.,
Superintendent,
Westinghouse Air Brake Company,
Wilmerding, Pa.

Landsperger, Elmer C.,
General Yard Master,
P. &. L. E. R. R.,
209 Monongahela Ave.,
Glassport, Pa.

Lang, W. C.,
Master Car Builder,
P. & L. E. R. R.,
McKees Rocks, Pa.

Langbein, Paul,
Clerk, Storehouse,
P. & L. E. R. R.,
106 West Undercliff St.,
Etna, Pa.

Lappe, J. C.,
President,
Lappe Supply Co.,
405 Penn Ave.,
Pittsburgh, Pa.

Larsen, Jacob C.,
Asst. to Mech. Engr.,
The Buckeye Steel
Castings Co.,
So. Parsons Ave.,
Columbus, Ohio.

Laughner, Carl L.,
Gen'l. Foreman, P. S. C. Co.,
1009 James St.,
N. S., Pittsburgh, Pt.

Laurent, George F.,
Sales Engineer,
Ft. Pitt Mall. Iron Co.,
3129 Landis St.,
Pittsburgh, Pa.

Laurent, Jos. A.,
Foreman, Finish Dept.,
Fort Pitt Mall. Iron Co.,
414 Broadway,
McKees Rocks, Pa.

Lawler, Joseph A.,
Sup't. Trans.,
Carnegie Steel Co.,
Edgar Thomson Works,
Braddock, Pa.

Lawson, A. F.,
Foreman Painter,
P. & L. E. R. R.,
322 Reifert St.,
Pittsburgh, Pa.

Lawson, Rowland R.,
Clerk, B. R. & P. Ry.,
2955 Merwyn Ave.,
Corliss Station,
Pittsburgh, Pa.

Leach, J. T.,
M. M., Penna System,
1001 Broadway,
Juniata P. O..
Altoona, Pa.

Leahy, Michael F.,
Sub-Foreman,
Pressed Steel Car Co.,
3420 Fleming Ave.,
N. S., Pittsburgh, Pa.

Leckey, Ralph F.,
Secretary and Treasurer,
William M. Bailey Co.,
721 Penn St.,
North Braddock, Pa.

Lee, Elisha,
Vice Pres., Penna. R. R. Sys.,
Broad Street Station,
Philadelphia, Pa.

Lee, L. A.,
Supt. Teleg., P. & L. E. R. R.,
64 Terminal Annex Bldg.,
Pittsburgh, Pa.

Lees, Thomas,
Reymer & Brothers, Inc.,
4128 Franklin Road,
N. S., Pittsburgh, Pa.

Leet, C. S.,
Land Agent,
B. & L. E. R. R.,
P. O. Box 456,
Pittsburgh, Pa.

Lehr, Harry W.,
Genl. Fore. Pass's. Car Insp.,
P. R. R. Co.,
6832 McPherson Blvd.,
Pittsburgh, Pa.

Leiper, C. I.,
Gen. Mgr., Central Region,
P. R. R. System,
Pennsylvania Station,
Pittsburgh, Pa.

Leisenring, W. J.,
Salesman,
American Locomotive Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Leonard, C. W.,
Salesman, Independent
Pneumatic Tool Co.,
718 Bessemer Bldg.,
Pittsburgh, Pa.

Leonard, D. E.,
President,
Gen. Equipment Co., Inc.,
342 Madison Ave.,
New York, N. Y.

Lewis, Goodrich Q.,
Mechanical Engineer,
W. H. Miner, Inc.,
Rookery Bldg.,
Chicago, Ill.

Lewis, Herbert,
Vice President,
Universal Packing Corp'n.,
108 Smithfield St.,
Pittsburgh, Pa.

Lewis, John H.,
Construction Dept.,
P. & L. E. R. R. Co.,
Wayne Apartments,
Beaver, Pa.

Lewis, Malcolm F.,
Asst. Trainmaster,
Penna. Railroad,
1828 Montier St.,
Wilkinsburg, Pa.

Lewis, Walter M.,
Gang Foreman,
Penna. Railroad System,
172 Olympia Street,
Pittsburgh, Pa.

Lightsell S. M.,
Boiler Foreman,
P. R. R.,
2674 Wind Gap Road,
Ingram, Pittsburgh, Pa.

Lincoln, John J., Jr.,
Air Reduction Sales Co.,
1116 Ridge Ave.,
N. S., Pittsburgh, Pa.

Lindahl, A. M.,
Y. M., Union R. R.,
1732 Laketon Road,
Wilkinsburg, Pa.

Lingle, Chas. M.,
Train Master,
P. & L. E. R. R. Co.,
1305 Union Ave.,
McKeesport, Pa.

Linsenbigler, Allen J.,
Gang Foreman,
Union Railroad,
200 Dixon Ave.,
East Pittsburgh, Pa.

Lobez, P. L.,
Designing Engineer,
Westinghouse Air Brake Co.,
418 Swissvale Ave.,
Wilkinsburg, Pa.

Lobough, Smith S.,
Conductor,
B. R. & P. Ry.,
209 Oakland Ave.,
Punxsutawney, Pa.

Lockard, Ira B.,
Gang Leader, Union R.R.,
607 Fawcett Ave.,
McKeesport, Pa.

Loeffler, George O.,
Sales Manager,
King Pneumatic Tool Co.,
Bessemer Bldg.,
Pittsburgh, Pa.

Lohr, Allen W.,
Commercial Engr.,
W. A. B. Co.,
1613 Laketon Road,
Wilkinsburg, Pa.

Long, Chas. R., Jr.,
Prest. Chas. R. Long Jr., Co.,
Louisville, Ky.

Long, R. M.,
Air Brake Inspector and
Instructor,
P. & L. E. R. R.,
McKees Rocks, Pa.

Long, Walter,
Walter Long Mfg. Co.,
14th & Muriel Sts.,
Pittsburgh, Pa.

Lorenzo, Dr. Frank,
Surgeon, B. R. & P. Ry.,
312 Union St.,
Punxsutawney, Pa.

Loudenbeck, H. C.,
Chief Chemist,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Loughner, Geo. D.,
Dist. Sales Manager,
Carbo-Oxygen Co.,
Benedum-Trees Bldg.,
Pittsburgh, Pa.

Lowe, W. D.,
Civil Engineer,
Koppers Co.,
2121 Federal St. Ext.,
N. S., Pittsburgh, Pa.

Lower, N. M.,
Assistant Gen. Mgr.,
Standard Stoker Co.,
Robinson and Darrah Sts.,
N. S., Pittsburgh, Pa.

Lowry, Wm. F., Jr.,
Salesman,
American Car &
Foundry Co.,
2215 Farmers Bank
Bldg.,
Pittsburgh, Pa.

Luddy, Wm. E.,
E. H. Fore.,
Penna. R. R. System,
7704 Stanton St.,
Swissvale, Pa.

Ludgate, B. A.,
Asst. Engineer,
P. & L. E. Railroad Co.,
Pittsburgh, Pa.

Lunden, Carl J.,
Draftsman,
P. & L. E. R. R.,
267 Fisk St.,
Pittsburgh, Pa.

Lustenberger, L. C.,
Asst. to Asst. Gen'l. Mgr.,
Sales, Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Lyman, Lynn S.,
Renewal Parts Eng'r.,
Westinghouse E. & M. Co.,
1133 Rebecca St.,
Wilkinsburg, Pa.

Lynch, Bernard J.,
Asst. Supervisor,
Mon. Con. R. R. Co.,
3202 Iowa St.,
Pittsburgh, Pa.

Lynch, C. A.,
Fort Pitt Steel Casting Co.,
5918 Douglas Ave.,
Pittsburgh, Pa.

Lynch, E. K.,
Special R. R. Rep.,
Chicago Pneum. Tool Co.,
923 Prescott Ave.,
Scranton, Pa.

Lynn, Sam'l.,
Supt. of Rolling Stock,
P. & L. E. R. R.,
McKees Rocks, Pa.

Lynn, Wm., Jr.,
Gen. Foreman Car Dept.,
P. & L. E. R. R.,
Box 377, R. D. 3,
Coraopolis Pa.

MacDonald, William C.,
Special Agent, Contracts,
Penna. R. R. System,
254 Allison Ave.,
Emsworth, Pa.

Mace, W. S.,
Yard Master,
Aliquippa & Southern R. R.,
1815 McMinn St.,
Aliquippa, Pa.

Mackert, A. A.,
Asst. to Asst Chief Engineer,
W. A. B. Co.,
450 Caldwell Ave.,
Wilmerding, Pa.

Magill, W. E.,
D. F. A.,
B. & O. R. R.,
474 Teece Ave.,
Bellevue, Pa.

Maley, W. E.,
Supervisor, Bridges & Bldgs.,
B. R. & P. Ry.,
115 Grant St.,
DuBois, Pa.

Maliphant, C. W.,
Test Dept.,
W. A. B. Co.,
101 Herman Ave.,
Wilmerding, Pa.

Mann, Henry S.,
Dist. Sales Mgr.,
Standard Stoker Co., Inc.,
1903 McCormick Bldg.,
Chicago, Ill.

Manogue, W. T.,
Sales Engineer,
Sunbeam Elec. Mfg. Co.,
549 W. Fishers Ave.,
Philadelphia, Pa.

Manson, Arthur J.,
Traction Apparatus Manager,
Westinghouse Electric & Mfg.
Company,
700 Braddock Ave.,
East Pittsburgh, Pa.

Mantell, W. T.,
Salesman,
Pgh. Screw & Bolt Corp.,
4400 Center Ave.,
Pittsburgh, Pa.

Margiotti, Chas. J.,
Attorney,
B. R. & P. Ry.,
720 W. Mahoning St.,
Punxsutawney, Pa.

Marlow, Geo. A.,
Chief Car Inspector,
Penna. R. R.,
575 Broad St. Station,
Philadelphia, Pa.

Marquis, Geo. E.,
Trainmaster,
P. & L. E. R. R.,
702 Sixth Ave.,
New Brighton, Pa.

Marsh, F. E.,
Salesman,
Nathan Manufacturing Co.,
R. F. D. No. 2,
West Chester, Pa.

Marshall, Craig W.,
Eastern Sales Mgr.,
Sunbeam Elec. Mfg. Co.,
1720 Grand Cen. Terminal,
New York, N. Y.

Martin, J. Howard,
Vice Pres. & Sales Mgr.,
American Die & Forge Co.,
Box 9,
Swissvale, Pa.

Martin, T. J.,
Asst. Train Master,
Monon Div., P. R. R.,
425 Fourth St.,
Monongahela, Pa.

Mason, S. O.,
Foreman,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Masterman, T. W.,
Test Engineer,
Westinghouse Air Brake Co.,
1249 McClure Ave.,
East McKeesport, Pa.

Masters, Wm. C.,
Sales, Engineer,
Graham Bolt & Nut Co.,
P. O. Box 455,
Pittsburgh, Pa.

Matchett, H. K.,
238 Grant Ave.,
Bellevue, Pa.

Matchneer, Wm. W.,
Sales Dept.,
Buckeye Steel Castings Co.,
Columbus, Ohio.

Mateer, W. H.,
Director of Purchases,
Standard Steel Car Co.,
Butler, Pa.

Matheny, George W.,
Yard Conductor,
P. & L. E. R. R.,
1808 Jenny Lind St.,
McKeesport, Pa.

Mathis, B. H.,
Treasurer,
Warren Tank Car Co.,
Warren, Pa.

Matthews, R. J.,
Salesman,
Edgewater Steel Co.,
P. O. Box 249,
Pittsburgh, Pa.

Mauck, E. A.,
Air Brake Inspector,
Union Railroad,
Box 55,
North Bessemer, Pa.

Col. Maxfield, H. H.,
S. M. P., Southern Div.,
Penna. Railroad,
402 Pennsylvania Bldg.,
Wilmington, Del.

Maxwell, R. E.,
Wheel Engineer,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Meehan, C. L.,
Asst. Train Master,
Aliquippa & Southern R. R.,
1929 Irwin St.,
Aliquippa, Pa.

Megogney, Frank M.,
Statisticain,
P. & L. E. R. R.,
624 P. & L. E.,
Terminal Bldg.,
Pittsburgh, Pa.

Merscher, John,
Foreman Car Repairs,
P. & L. E. R. R.,
348 Woodward Ave.,
McKees Rocks, Pa.

Mertz, G. H.,
Freight Agt., M. C. R. R.,
4035 Murray Ave.,
Pittsburgh, Pa.

Mertz, Jacob J.,
Gang Foreman Car Dept.,
P. & L. E. R. R.,
Glenwillard, Pa.

Meyer, G. K.,
Salesman,
Bock-Stauffer Co.,
3407 Shadeland Ave.,
N. S., Pittsburgh, Pa.

Meyer, Wendel J.,
Chief Engineer,
O. C. Duryea Corp'n.,
R. D. 7,
Butler, Pa.

Meyers, August J.,
Locomotive Machinist,
Aliquippa & Southern R. R.,
Vanport, Pa.

Milby, T. A.,
Investigator for the State
Auditor General of Pa.,
309 Grace St.,
Pittsburgh, Pa.

Miles, Harry E.,
Yard Master,
Union Railroad Co.,
5427 Claybourne St.,
Pittsburgh, Pa.

Miles, W. E.,
President,
Miles & Co., Inc.,
Dubois, Pa.

Millar, Clarence W.,
Mgr. Order Dept.,
Pressed Steel Car Co.,
McKees Rocks, Pa.

Miller, George,
Piece-work Inspector,
P. & L. E. R. R. Co.,
3228 Sacramento Ave.,
Pittsburgh, Pa.

Miller, J. Alfred,
Gen. Mgr. of Sales,
Vanadium Corp. of America,
Oliver Building,
Pittsburgh, Pa.

Miller, J. F.,
Sales Engineer,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Miller, John,
Gen. Car Fore., Montour Railroad,
5127 Blair St.
Hazelwood, Pa.

Miller, L. L.,
Labor Foreman,
P. & L. E. R. R. Co.,
2900 Merwyn Ave.,
Pittsburgh, Pa.

Milliken, C. C.,
Traffic Dispatcher,
Universal Portland Cement Co.,
517 Frick Bldg.,
Pittsburgh, Pa.

Milliken, I. H.,
Vice Pres., The McConway & Torley Co.,
48th St. and A. V. Ry.,
Pittsburgh, Pa.

Milliken, Col. Jas.,
President, Pitts. Test. Lab.,
4914 Center Ave.,
Pittsburgh, Pa.

Mills, C. C.,
Vice Pres. & Gen. Manager,
Unity Railways Co.,
619 Union Trust Bldg.,
Pittsburgh, Pa.

Miner, W. H.,
Railway Supplies,
Rookery Bldg.,
Chicago, Ill.

Minnick, F. G.,
General Manager,
P. & L. E. R. R.,
308 Lincoln Ave.,
Bellevue, Pa.

Misner, George W.,
Westinghouse Air Brake Co.,
304 Arlington Ave.,
East McKeesport, Pa.

Mitchell, Frank K.,
Signal Insp'r., P. & L. E. R. R.,
1218 House Bldg.,
Pittsburgh, Pa.

Mitchell, J. G..
Sub-Storekeeper,
Union Railroad,
3 Duquesne Boulevard,
Duquesne, Pa.

Mitchell, J. Wallace,
Salesman,
Pitts. Forge & Iron Co.,
1306 C. of Commerce Bldg.,
Pittsburgh, Pa.

Mitchell, John H.,
Standard Steel Car Co.,
Frick Bldg.,
Pittsburgh, Pa.

Mitchell, W. S.,
Signal Inspector,
P. and L. E. R. R.,
540 First St.,
Beaver, Pa.

Mogan, John M.,
General Yard Master,
P. & L. E. R. R.,
119 Overbrook Blvd.,
Pittsburgh, Pa.

Mohn, Louis,
District Manager,
Garlock Packing Co.,
Frontenac Apts.,
Highland Ave.,
Pittsburgh, Pa.

Moir, W. B.,
Chief Car Inspr.,
Penna. Railroad,
521 Penna. Station,
Pittsburgh, Pa.

Molyneaux, Dawes S.,
Sales Engineer,
Ft. Pitt Spring Co.,
Box 917,
Pittsburgh, Pa.

Monks, J. J.,
Freight Traffic Manager,
P. & L. E. R. R.,
Pittsburgh, Pa

Montgomery, J. L.,
C. C., Accounting Dept.,
Union R. R.,
1418 Carnegie Bldg.,
Pittsburgh, Pa.

Montgomery, Wm. J.,
Railway Representative,
The Sherwin Williams Co.,
601 Canal Road,
Cleveland, Ohio

Moody, M. R.,
Mfg. Engineer,
Westinghouse E. & M. Co.,
1031 Macon St.,
Pittsburgh, Pa.

Moore, Donald O.,
Mgr. of Traffic Div.,
Chamber of Commerce,
Chamber of Com. Bldg.,
Pittsburgh, Pa.

Moore, Frank,
Pres't. Pgh. Malleable Iron Co.,
1406 Clark Bldg.,
Pittsburgh, Pa.

Moore, Ray L.,
Asst. Superintendent,
B. R. & P. Ry.,
Punxsutawney, Pa.

Moreland, Evan L.,
Machine Shop Foreman,
Montour Railroad,
1215 Hiland Ave.,
Coraopolis, Pa.

Morgan, A. L.,
Supt. on Special Duty,
Penna. R. R. System,
24 Maple Ave.,
Woodlawn,
Wheeling, W. Va.

Morris, J. H.,
Fuel Sup'vr., B. R. & P. Ry.,
704 E. Mahoning St.,
Punxsutawney, Pa.

Morris, J. M.,
Traffic Manager,
National Tube Co.,
1922 Frick Bldg.,
Pittsburgh, Pa.

Morrow, Robt. T.,
Asst. to Vice Pres.,
Penna. System,
401 Roup Ave.,
Pittsburgh, Pa.

Morrow, Wilson,
Division Engineer,
B. R. & P. Ry.,
113 W. DuBois Ave.,
DuBois, Pa.

Morse, J. W.,
Asst. R. F. of E.,
Penna. System,
P. O. Box 892,
Youngwood, Pa.

Moses, Graham Lee,
Elec. Engr., Westinghouse
Elec. & Mfg. Co.,
407 Franklin Ave.,
Wilkinsburg, Pa.

Moulis, F. J.,
Cashier, B. R. & P. Ry.,
1222 Voskamp St.,
N. S., Pittsburgh, Pa.

Mourer, Charles W.,
Special Work,
Pressed Steel Car Co.,
148 Taylor Ave.,
Beaver, Pa.

Moxey, Arthur C.,
Railway Salesman,
Scientific Produc. Corp.,
311 W. Cunningham St.,
Butler, Pa.

Moyer, Oscar G. A.,
Engineer, Rieck-McJunkin
Dairy Co.,
2236 Lutz Ave.,
Mt. Oliver Sta., Pgh., Pa.

Mulvey, John I.,
Traffic Manager,
Hubbard & Co.,
6301 Butler St.,
Pittsburgh, Pa.

Munn, Alex D.,
First Aid Inspector,
P. & L. E. R. R.,
Glenwillard, Pa.

Murphy, Daniel,
Yardmaster, P. & L. E. R. R.,
124 Stewart St.,
Mt. Oliver Sta.,
Pittsburgh, Pa.

Murray, Donald,
President,
Murray Safety Sling Co.,
1015 South Ave.,
Wilkinsburg, Pa.

Murray, James S.,
Mfg. Agent,
Goddard & Goddard, Inc.,
392 Hazel Drive,
Mt. Lebanon, Pa.

Murray, M. H.,
Salesman,
United Oil Co.,
906 Steuben St.,
Pittsburgh, Pa.

Murray, Thomas,
Freight Conductor,
P. & L. E. R. R.,
601 Atlantic Ave.,
McKeesport, Pa.

Muse, Thos. Charles,
Traveling Car Agent,
P. & L. E. R. R.,
253 Fourth St.,
Beaver, Pa.

Myers, Arnold,
R. R. Equip't. Insp'r.,
Carnegie Steel Co.,
R. F. D., 1 Box 338,
Homestead, Pa.

Myers, R. C.,
Storekeeper,
Monongahela Ry. Co.,
Brownsville, Pa.

Myers, Walter H.,
Chief Clerk to Mech. Supt.,
Montour R. R. Co.,
P. O. Box 161,
West Bridgewater, Pa.

McAbee, W. S.,
Vice Pres. & Gen. Supt.,
Union R. R.,
5239 Gertrude St.,
Pittsburgh, Pa.

McCabe, James F.,
Train Dispatcher,
P. & L. E. R. R.,
319 Chartiers Ave.,
McKees Rocks, Pa.

McCandless, Geo. W.,
Treasurer, The
McConway & Torley Co.,
48th St. and A. V. Ry.,
Pittsburgh, Pa.

McCarthy, F. W.,
Supt. Car Operation,
Pittsburgh Railways Co.,
170 Steuben Ave.,
Pittsburgh, (5) Pa.

McCartney, John H.,
District Manager,
James B. Sipe & Co.,
165 Broadway,
New York, N. Y.

McCauley, Wm.,
R. F. of E. Penna. System,
28 Kerr St.,
Uniontown, Pa.

McClintock, John D.,
Manager, Injector Dept.,
Wm. Sellers & Co., Inc.,
1600 Hamilton St.,
Philadelphia, Pa.

McCloskey, J. C.,
Clerk, Union R. R. Co.,
2227 Woodstock Ave.,
Swissvale, Pa.

McComb, R. J.,
Sales Manager,
Woodings Forge & Tool Co.,
Verona, Pa.

McConnell, Allen L.,
Car Distributor,
P. & L. E. R. R.,
127 Fitler St
Pittsburgh, Pa.

McConnell, Frank P.
Yardmaster,
P. & L. E. R. R.,
210 Eleanor St.,
S. S., Pittsburgh, Pa.

McConway, Wm., Jr.,
Vice President, The
McConway & Torley Co.,
48th St. and A. V. Ry.,
Pittsburgh, Pa.

McCornish, W. C.,
Gang Foreman,
Penna. Railroad,
Second Ave.,
Conway,
Beaver Co., Pa.

McCready, Arthur,
Gang Foreman,
Union Railroad,
547 Ninth Ave.,
Munhall, Pa.

McCuen, J. T.,
Salesman, Motch & Merryweather Machinery Co.,
Clark Bldg.,
Pittsburgh, Pa.

McCully, B. N.,
Fore. Car Repairs,
Penna. System,
800 Wood St.,
Wilkinsburg, Pa.

McCune, J. C.,
Asst. Director Engineering,
Westinghouse Air Brake
Company,
Wilmerding, Pa.

McDonald, John A.,
119 Carson St.,
S. S., Pittsburgh, Pa.

McDowell, C. G.,
Chief Clerk,
American Rwy. Express Co.,
926 Penn Avenue,
Pittsburgh, Pa.

McElravy, J. W.
Terminal Agent,
P. & L. E. R. R.,
Terminal Annex Bldg.,
S. S., Pittsburgh, Pa.

McGarrigle, Jos., J.,
Sales Engineer,
The Thew Shovel Co.,
204 W. Phila. Title Bldg.,
Philadelphia, Pa.

McGaw, William L.,
Shop Foreman,
McKeesport Connecting R. R.,
1407 Manor Ave.,
McKeesport, Pa.

McGeorge, D. W.,
Asst. Secretary,
Edgewater Steel Co..
P. O. Box 249,
Pittsburgh, Pa.

McGinley, T. A.,
President,
The Duff-Norton Mfg. Co.,
P. O. Box 555,
N. S., Pittsburgh, Pa

McGinnis, Thomas P.
District Sales Manager,
The Pyle-National Co.,
420 Oliver Bldg.,
Pittsburgh, Pa.

McGowan, Chas. H.,
Draftsman, P. S. C. Co.,
415 Jefferson Ave..
Bellevue, Pa.

McHugh, C. A.,
Asst. Trainmaster,
P. & W. Va. Ry.,
21 Cannon St.,
Crafton, Pa.

McIlwain, J. P.,
Freight Agent,
P. & L. E. R. R.,
63 Greenbush Street,
Pittsburgh, Pt.

McIntyre, R. C.,
Asst. Master Mechanic,
Union Railroad,
403 Braddock Ave.,
Pittsburgh, Pa.

McKalip, James C.,
General Auditor,
B. & L. E. R. R. Co.,
P. O. Box 456,
Pittsburgh, Pa.

McKean, Joseph D.,
P. W. I.—P. & L. E. R. R.,
401 Lorenz Ave.,
Pittsburgh, Pa.

McKedy, H. V.,
Rep., Railway Dept.,
The Patterson, Sargent Co.,
30 Church St.,
New York, N. Y.

McKee, Frederick C.,
Pres., Winfield R. R.,
2215 Oliver Bldg.
Pittsburgh, Pa.

McKee, S. Frank,
Asst. to Gen. Mgr.,
Pressed Steel Car Co.,
McKees Rocks, Pa.

McKelvey, J. E.,
Asst. Gen. Mgr. Sales,
Neeley Nut & Bolt Co.,
21st and Wharton Sts.,
Pittsburgh, Pa.

McKinley, Archie,
Chief Motive Power Inspt'r.
P. & L. E. R. R.,
613 Broadway Ave.,
McKees Rocks, Pa.

McKinstry, C. H.,
Asst. to Engr. of Tests,
W. A. B. Co.,
46 Sprague St.,
Wilmerding, Pa.

McKinzie, Edward,
General Yardmaster,
P. & W. Va. Ry.,
R. D. 8, Crafton P. O.,
Rook, Pa.

McLain, J. E.,
Manager of Sales,
Bethlehem Steel Co.,
1807 Oliver Bldg.,
Pittsburgh, Pa.

McLaughlin, Howard B.,
R. F. of E.,
P. & L. E. R. R.,
3021 Ashlyn St.,
Corliss Station,
Pittsburgh, Pa.

McLaughlin, L. S.,
Car Inspector,
P. & L. E. R. R.,
R. D. No. 2,
Beaver Falls, Pa.

McMahon, H. R.,
President,
Standard Steel Spring Co.,
843 Fourth Ave.,
Coraopolis, Pa.

McManus, Charles J.,
Gang Foreman,
Penna. Railroad System,
3628 Liberty Avenue,
Pittsburgh, Pa.

McMillan, A. P.,
Boiler Foreman,
P. & W. Va. Ry.,
928 Western Ave.,
N. S., Pittsburgh, Pa.

McMillan, F. C.,
Office Trainmaster,
P. & L. E. R. R.,
1043 Biltmore Ave.,
South Hills Branch,
Pittsburgh, Pa.

McMullen, Clark E.,
Inspector Transportation,
P. & L. E. R. R. Co.,
Maple St. Extension,
Coraopolis, Pa.

McMurray, Arthur E.,
Chief Statistician,
P. & L. E. R. R.,
Pittsburgh, Pa.

McNamee, William W.,
District Manager,
Briggs & Turivas Co.,
37 Marion St.,
Crafton, Pa.

McNaughton, W. H.,
Passenger Conductor,
B. R. & P. Ry.,
196 Crescent Ave.,
Buffalo, N. Y.

McNelty, A. P.,
Car Distributor,
P. & L. E. R. R.,
2950 Voelkel Avenue,
Dormont, Pittsburgh, Pa.

McPherson, A. R.,
Trainmaster,
Montour Railroad,
Ridge Ave.,
Coraopolis, Pa.

McQuillen, J. J.,
President,
Universal Packing Corp.,
108 Smithfield St.,
Pittsburgh, Pa.

McQuiston, J. C.,
Advertising Manager,
Westinghouse Elec. &
Mfg. Co.,
East Pittsburgh, Pa.

Nagel, James,
Superintendent Transfer,
Montour Railroad,
Ferree St.,
Coraopolis, Pa

Nannah, F. J.,
Engr. of Construction,
P. & L. E. R. R.,
Pittsburgh, Pa.

Nash, R. L.,
Test Engineer,
Westinghouse Air Brake Co.,
437 Franklin Ave.,
Wilkinsburg, Pa.

Nath, George J.,
Gen Yard Master,
Mon. Con. R. R. Co.,
2226 Spring St.,
Mt. Oliver,
Pittsburgh, Pa.

Neal, E. J.,
Piece-work Clerk &
Estimator,
Pressed Steel Car Co.,
1176 Dohrman St.,
Stowe Township, Pa.

Neal, O. H.,
Eastern Sales Manager,
Union Asbestos & Rubber
Company,
30 Church St.,
New York, N. Y.

Neff, John P.,
Vice President,
American Arch Co.,
17 E 42nd St.,
New York, N. Y.

Nelson, R. F.,
Draftsman,
Chartiers Southern Ry. Co.,
1200 Century Bldg.,
Pittsburgh, Pa.

Nelson, W. M.,
Supervisor, Air Brakes,
B. R. & P. Ry.,
12 Kent Boulevard,
Salamanca, N. Y.

Ness, H. S.,
Freight Agent,
B. R. & P. Ry.,
N. S., Pittsburgh, Pa.

Nessle, J. B.,
Traffic Mgr.,
P. & L. E. R. R.,
P. & L. E. Term. Bldg.,
Pittsburgh, Pa.

Nethken, H. W.,
Vice President,
Pgh. & West Va. R. R.,
405 Wabash Bldg.,
Pittsburgh, Pa.

Nichol, W. K.,
Chief Clerk to Gen'l Supt.,
B. R. & P. Ry.,
15 Rumbarger Ave.,
DuBois, Pa.

Niel, Ed. A.,
Freight Traffic Manager,
B. R. & P. Ry.,
155 W. Main St.,
Rochester, N. Y.

Nieman, Charles J.,
Secretary-Treasurer,
Penn Iron & Steel Co.,
Creighton, Pa.

Nieman, H. L.,
Gang Foreman,
P. & L. E. R. R.,
208 Copeland St.,
McKees Rocks, Pa.

Noble, Jesse A.,
Supv'r. Bridges & Bldgs.,
P. & L. E. R. R.,
1643 Broadway,
McKees Rocks, Pa.

Noonan, W. T.,
President,
B. R. & P. Ry. Co.,
155 West Main St.,
Rochester, N. Y.

Nordfelt, H. C.,
Sales Engineer,
Continental Sales & Engrg. Co
Oliver Bldg.,
Pittsburgh, Pa.

Norris, J. L.,
R. F. of E., B. & O. R. R.,
4818 Chatsworth St.,
Pittsburgh, Pa.

Nutt, Col. H. C.,
Pres. & Gen. Mgr.,
Monongahela Rwy. Co.,
Century Bldg.,
Pittsburgh, Pa.

Oberlin, A. C.,
Auditor,
Schaefer Equipment Co.,
Koppers Building,
Pittsburgh, Pa.

Obermeier, L. J.,
Machinist,
Penna. R. R. System,
722 9th St.,
Pitcairn, Pa.

O'Boyle, Charles M.,
President,
Royal Railway Supply Co.,
90 Wect St.,
New York, N. Y.

O'Brien, Martin J.,
Pres., Martin J. O'Brien Co.,
1607 Union Bank Bldg.,
Pittsburgh, Pa.

O'Connor, C. D.,
Supt. Transportation,
Vesta Coal Co.,
Pittsburgh, Pa.

O'Connor, M. J.,
Rep., Dearborn Chemical Co.,
618 Farmers Bank Bldg.,
Pittsburgh, Pa.

Ogden, F. A.,
General Freight Agent,
Jones & Laughlin Steel Co.,
Pittsburgh, Pa.

Ogden, Geo. D.,
Asst. Vice President,
Penna. Railroad,
Pennsylvania Sta.,
New York, N. Y.

O'Leary, Jeremiah J.,
Machinist, Penna. System,
132 Fourth St.,
Oakmont, Pa.

O'Malley, J. N.,
Foreman, B. & O. R. R. Co.,
5130 Second Ave.,
Pittsburgh, Pa.

Orbin, Geo. N.,
Retired,
Engineman, B. & O. R. R.,
2945 Glenmore Ave.,
Dormont, Pittsburgh, Pa.

Orchard, Chas.,
Special Agent,
Traffic Dept., Carnegie
Steel Co.,
Carnegie Buldg.,
Pittsburgh, Pa.

Orr, D. K.,
Superintendent,
The Monongahela Ry. Co.,
Brownsville, Pa.

Osborne, H. C.,
Supvr. of Water Supply,
P. & L. E. R. R.,
250 Wilson Ave.,
Beaver, Pa.

Osborne, Wm. J.,
Gen. Elec. Fore., Union R. R.,
8 Norman St.,
Duquesne, Pa.

Oskin, Wm.,
Ass't. Foreman,
W. A. B. Co.,
1250 Broadway St.,
East McKeesport, Pa.

O'Sullivan, John J.,
Pipe Fitter, P. & L. E. R. R.,
1130 Wayne Ave.,
McKees Rocks, Pa.

O'Toole, J. L.,
Supt. Frt. Transportation,
P. & L. E. R. R.,
612 Terminal Bldg.,
Pittsburgh, Pa.

O'Toole, Thomas J.,
Clerk, B. & O. R. R. Co.,
5138 Gloster St.,
Pittsburgh, Pa.

Owen, A. T.,
Supt. Transportation,
Reading Company,
Reading Terminal,
Philadelphia, Pa.

Pacey, E. H.,
President,
Pittsburgh Welding Corp.,
33 Water St.,
Pittsburgh, Pa.

Painter, Chas. Leroy,
Engr., West E. & M. Co.,
614 Third St.,
Pitcairn, Pa.

Painter, Jos.,
Railway Equipment,
1208 Manhattan St.,
Pittsburgh, Pa.

Paisley, F. R.,
Inspecting Engineer,
P. & L. E. R. R. Co.,
1111 Stanford Road,
N. S., Pittsburgh. Pa.

Palmer, E. A.,
Traction Apparatus Sales,
Westinghouse Elec. &
Mfg. Company,
564 East End Ave.,
Pittsburgh, Pa.

Partington, Joshua A.,
225 Cornell Ave.,
Bellevue Branch,
Pittsburgh, Pa.

Paschold, Curtis H.,
Claim Agent,
Legal Dept.,
Penna. R. R.,
417 Chestnut Rd.,
Sewickley, Pa

Passino, F. J.,
Mgr., Pgh. Dist.,
Inde. Pneu. Tool Co.,
718 Bessemer Bldg.,
Pittsburgh, Pa.

Passmore, H. E.,
5668 Darlington Road,
Pittsburgh, Pa.

Passmore, H. E., Jr.,
National Tube Co.,
Frick Bldg.,
Pittsburgh, Pa.

Pastre, Harry A.,
Supervisor District,
Offices, Elliott Co.,
718 Frick Bldg.,
Pittsburgh, Pa.

Patterson, J. E.,
"Retired" Loco. Engr.,
U. R. R.,
7236 McClure Ave.,
Swissvale, Pa.

Patton, William T.,
Head of Time Study Dept.,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Paul, Lesley C.,
Transportation Section,
W. E. & Mfg. Co.,
159 Woodside Road,
Forest Hills Boro.,
Wilkinsburg, Pa.

Payne, H. A.,
Credit Manager,
Pgh. Screw & Bolt Corp.,
P. O. Box 752,
Pittsburgh, Pa.

Pehrson, A. K.,
Mech. Engr.,
Pressed Steel Car Co.,
McKees Rocks, Pa.

Peiffer, C. E.,
Master Car Builder,
B. R. & P. Ry.,
129 West Long Ave.,
DuBois, Pa.

Penrod, Homer F.,
Yardmaster,
P. & L. E. R. R.,
231 South Ninth St.,
Connellsville, Pa.

Penton, John A.,
President, The Penton Pub. Co.,
Cleveland, Ohio

Peoples, Jas. S.,
Freight T. M., P. R. R. Co.,
2610 N. Sixth St.,
Harrisburg, Pa.

Perkins, Chas. F.,
General Manager,
Davis Brake Beam Co.,
Box 982,
Johnstown, Pa.

Perry, W. E.,
Special Agent,
Central Region,
Penna. R. R. System,
Room 404, Penna. Sta.,
Pittsburgh, Pa.

Person, G. H.,
Signal Supervisor,
B. R. & P. Ry.,
117 Scribner Ave.,
DuBois, Pa.

Peterson, William,
Yardmaster,
P. & L. E. R. R.,
1404 Pirl Street,
McKeesport, Pa.

Pfrom, E. L.,
Asst. Suprv. of Track,
P. & L. E. R. R.,
745 Mary Street,
McKees Rocks, Pa.

Pickard, Frank C.,
Works Manager.
Standard Stoker Co., Inc.,
Erie, Pa.

Pickard, S. B.,
Chief Electrician,
P. & L. E. R. R.,
604-A Broadway,
McKees Rocks, Pa.

Pillar, Michael,
Piece Work Inspector,
P. & L. E. R. R.,
206 Jane St.,
McKees Rocks, Pa.

Platt, J. G.,
Pres. and Gen. Manager,
Hunt-Spiller Mfg. Corp.,
383 Dorchester Ave.,
So. Boston, Mass.

Porter, H. T.,
Chief Engineer,
B. & L. E. R. R. Co.,
Greenville, Pa.

Porter, P. P.,
Foreman, Air Brake Dept.,
Montour Railroad,
134 Jackson St.,
Bellevue, Pa.

Posteraro, S. F.,
Frt. Cashier,
B. & O. R. R.,
Grant and Water Sts.,
Pittsburgh, Pa.

Postlethwaite, C. E.,
Asst. Vice President,
Pressed Steel Car Co.,
55 Broad St.,
New York, N. Y.

Prentice, L. V.,
Asst. Station Master,
P. & L. E. R. R.,
258 Southern Ave.,
Pittsburgh, Pa.

Prince, Albert,
Asst. Foreman,
P. & L. E. R. R.,
3043 Glenmawr Ave.,
Corliss Station,
Pittsburgh, Pa.

Pringle, Arthur D.,
Supvr. Wage Schedule,
Monongahela Railway,
609 Water St.,
South Brownsville, Pa.

Pringle, F. D.,
Surgeon,
B. R. & P. Ry.,
205 So. Penn St.,
Punxsutawney, Pa.

Pringle, H. C.,
Supt., Mon. Con. R. R.,
McCully St. & Marlin Drive,
Mt. Lebanon, Pittsburgh, Pa

Pringle, J. L.,
Trainmaster.
Penna. Railroad,
115 Delafield Ave.,
Aspinwall, Pa.

Pringle, P. V.,
Commercial Engineer,
Westinghouse Air Brake Co.,
811 South Ave.,
Wilkinsburg, Pa.

Prouty, Eugene,
Service Engineer,
Standard Stoker Co., Inc.,
210 West Eighth St.,
Erie, Pa.

Provost, S. W.,
Office Mgr., Am. Loco. Co.,
617 Farmers Bank Bldg.,
Pittsburgh, Pa.

Pugh, Clifford, F.,
Ry. Watch Inspector,
Pugh Bros.,
House Bldg.,
Pittsburgh, Pa

Pugh, William,
Asst. Gen. Freight Agent,
B. R. & P. Ry.,
155 W. Main St.,
Rochester, N. Y.

Purnell, Charles G.,
Inspector, Metallurgical Dept.,
Carnegie Steel Co.,
Frick Bldg., Annex,
Pittsburgh, Pa.

Pye, David W.,
President,
Tuco Products Corp'n.,
30 Church St.,
New York, N. Y.

Rabold, W. E.,
Chief Clerk, P. R. R. Co.,
366 Lehigh Ave.,
E. E., Pittsburgh, Pa.

Ragner, Geo. O.,
Secretary,
Beck, Riley & Hall Equip. Co.,
458 Union Trust Bldg.,
Pittsburgh, Pa.

Ralston, John A.,
Mech. Engr., U. R. R. Co.,
Frick Annex,
Pittsburgh, Pa.

Rambo, Jay B.,
Asst. R. F. of E.,
Pennsylvania R. R.,
218 Fifth St.,
Aspinwall, Pa.

Rankin, B. B.,
Asst. Gen. Auditor,
P. & L. E. R. R.,
1502 Park Blvd.,
Dormont,
Pittsburgh, Pa.

Raser, Geo. B.,
Sales Engr.,
Ingersoll-Rand Co.,
706 Chamber of Com. Bldg.,
Pittsburgh, Pa.

Rauschart, E. A.,
Mech. Supt., Montour R. R.,
Coraopolis, Pa.

Raymer, I. S.,
Signal Engineer,
P. & L. E. R. R.,
959 Fourth Ave.,
Beaver, Pa.

Read, A. A.,
Duquesne Slag Products Co.,
806 Diamond Bank Bldg.,
Pittsburgh, Pa.

Read, Harry J.,
Assistant Cashier,
P. & L. E. R. R.,
80 Wyoming Street,
Pittsburgh, Pa.

Ream, A. H.,
S. M. P. & E.,
P. & S. R. R.,
Brookville, Pa.

Reardon, M. J.,
Gen. Y. M., P. & L. E. R. R.,
638 Fifth Ave.,
Coraopolis, Pa.

Reardon, John P.,
Sub-Foreman,
Pressed Steel Car Co.,
704 Shade Ave.,
Bellevue, Pa.

Record, J. Fred,
Supt. of Production,
Westinghouse Air Brake
Company,
Wilmerding, Pa.

Reddick, Warren E.,
Clerk,
P. & L. E. R. R.,
1114 Faulkner St.,
Corliss Sta.,
Pittsburgh, Pa.

Redding, J. H.,
General Supt.,
Penna. R. R. Sys.,
Penna. Station,
Pittsburgh, Pa.

Redding, P. E.,
Special Rep.,
Johns-Manville Corp'n.,
Westinghouse Bldg.,
Pittsburgh, Pa.

Redding, R. D.,
General Foreman,
P. & L. E. R. R. Co.,
Campbell, Ohio

Rees, Harry,
Master Mechanic,
B. & O. Shops,
Akron, Ohio.

Reeves, George,
Fore. Electrical Dept.,
Ft. Pitt Malleable Iron Co.,
330 Woodward Ave.,
McKees Rocks, Pa.

Regan, W. J.,
Mechanical Engineer,
The McConway-Torley Co.,
48th St. & A. V. Ry.,
Pittsburgh, Pa.

Reid, Samuel,
Inspecting Engineer,
P. & L. E. R. R.,
411 Eleventh St.,
Beaver Falls, Pa.

Reifsnyder, J. W.,
Engineer of Tests,
Pgh. Testing Laboratory,
Stevenson & Locust Sts.,
Pittsburgh, Pa.

Renshaw, W. B.,
Asst. Dist. Engineer,
W. A. B. Co.,
Wilmerding, Pa.

Rex, Charles E.,
Asst. Engine House Fore.,
Pennsylvania R. R.,
233 Clifton Ave.,
Sharpsburg, Pa.

Reynolds, D. E.,
Purchasing Agent,
B. & L. E. R. R.,
687 Union Trust Bldg.,
Pittsburgh, Pa.

Richardson, F. E.,
President,
Pgh. Forge & Iron Co.,
Chamber of Com. Bldg.,
Pittsburgh, Pa.

Richardson, H. R.,
Suprv. of Wage Schedules,
P. & L. E. R. R.,
Pittsburgh, Pa.

Richardson, L. C.,
Sales Engineer,
Sunbeam Electric Mfg. Co.,
1720 Grand Central term.,
New York, N. Y.

Riddle, D. E.,
Traveling Auditor,
Florida East Coast R. R.,
131 King St.,
St. Augustine, Fla.

Ridgeway, James F.,
Foreman,
P. and L. E. R. R.,
711 Frederick St.,
McKees Rocks, Pa.

Ricker, H. M.,
Freight Agent,
P. & L. E. R. R.,
23rd Street,
S. S., Pittsburgh, Pa.

Riley, Geo. N.,
Supt. Motive Power,
McKeesport Con. R. R.,
Frick Building,
Pittsburgh, Pa.

Ritts, Wm. H.,
Steam Engineer,
Spang, Chalfant & Co.,
1 Pine St.,
Etna, Sharpsburg Sta., Pa.

Rizzo, C. M.,
Agent, P. & W. Va. Ry.,
Chestnut St.,
Castle Shannon, Pa.

Roan, Harry B.,
Fore., Loco. & Crane Repairs,
Jones & Laughlin Steel Corp.,
658 Franklin Ave.,
Aliquippa, Pa.

Roberts, A. L.,
International Nickel Co.,
67 Wall St.,
New York, N. Y.

Robertson, Harold,
Chief Clerk,
P. & L. E. R. R.,
Dickerson Run, Pa.

Robinson, R. L.,
Sales Representative,
The American Brake Shoe and Foundry Co.,
714 Roselawn Ave.,
S. H. B., Pittsburgh, Pa.

Rodda, G. A.,
Engineer,
P. H. B. & N. C. Ry.,
Harmony, Pa.

Rodibaugh, J. T.,
Conductor,
P. & L. E. R. R.,
940 Watson St.,
Coraopolis, Pa.

Rogan, John A.,
Supt. of Car Houses,
Pgh. Railways Co.,
Duquesne Bldg.,
Sixth Floor,
Pittsburgh, Pa.

Rogers, Robert,
Sales Agt., American Car & Fdry. Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Roney, H. E.,
Sig. Draftsman,
P. & L. E. R. R.,
3111 College Ave.,
Beaver Falls, Pa.

Root, E. E.,
Master Mechanic,
D. L. & W. R. R. Co.,
50 North Munn Ave.,
East Orange, N. J.

Ross, Robert J.,
Salesman,
Westinghouse Elec. & Mfg. Co.,
Walnut & 30th Sts.,
Philadelphia, Pa.

Rossell, R. T.,
President, B. & L. E. R. R.,
Union Trust Building,
Pittsburgh, Pa.

Roth, Philip J.,
P. W. Car Insp'r.,
P. & L. E. R. R.,
312 Anthony St.,
Mt. Oliver Sta.,
Pittsburgh. Pa.

Roush, Albert S.,
Supt. Telegraph,
P. & L. E. R. R.,
6735 Thomas Blvd.,
Pittsburgh, Pa.

Rowan, W. R. C.,
Estate Engineer,
Canada Life Assurance Co.,
140 Bigham St.,
Mt. Washington,
Pittsburgh, Pa.

Rowe, J. L.,
Mgr. R. R. Sales,
Chicago Pneu. Tool Co.,
6 East 44th St.,
New York City.

Rowland, F. S.,
Locomotive Engineer,
B. R. & P. Ry.,
14 Rumbarger Ave.,
DuBois, Pa.

Rudd, W. B.,
General Engineer,
Union Switch & Signal Co.
Swissvale, Pa.

Rumbarger, F. A.,
1847 Koppers Bldg.,
Pittsburgh, Pa.

Rushneck, George L.,
Draftsman,
P. & L. E. R. R.,
41 P. & L. E. Annex Bldg.,
Pittsburgh, Pa.

Ryan, D. W.,
Chief Clerk, Order Dept.,
Ft. Pitt Malleable Iron Co.,
3138 Landis St.,
Pittsburgh, Pa.

Ryder, Gilbert E.,
Vice President,
The Superheater Co.,
17 East 42nd St.,
New York City.

Rys. C. F. W.,
Assistant to President,
Carnegie Steel Co.,
517 Carnegie Bldg.,
Pittsburgh, Pa.

Salisbury, William,
Trav. Car Insp'r.,
P. & L. E. R. R.,
Box 175,
Newell, Pa.

Sallinger, Howard H.,
Rate Clerk,
B. & O. R. R. Co.,
3114 Niagara St.,
Oakland, Pittsburgh, Pa.

Saltic, Thos.,
Supt. of Furnaces,
Ft. Pitt Malleable Iron Co.,
321 Russellwood Ave.,
McKees Rocks, Pa.

Sample, W. E.,
Supervisor Loco. Operation,
B. & O. R. R.,
Pittsburgh, Pa.

Sanders, George,
Gen. Foreman, Mech. Dept.,
Union Railroad,
565 Negley Ave.,
Turtle Creek, Pa.

Sanders, Walter C.,
Gen. Mgr., Ry. Div.,
Timken Roller Bearing Co.,
1133 Fulton Road,
Canton, Ohio

Sandman, A. G.,
Asst. to Chief of M. P.,
& Equip't., B. & O. R. R.,
702 B. & O. Central Bldg.,
Baltimore, Md.

Sanfillip, P. C.,
Electrical Stockkeeper.
P. & L. E. R. R.,
112 Beam Way,
Mt. Washington Sta.,
Pittsburgh, Pa.

Sattley, E. C.,
Vice Pres.,
The Champion Sales Co.,
604 Chamber of Commerce
Bldg.,
Pittsburgh, Pa.

Sauer, George L.,
Freight Agent,
P. & L. E. R. R.,
McKeesport, Pa.

Sawyer, R. W.,
Salesman,
Penna. & Ohio Lumber Co.,
2203 Oliver Bldg.,
Pittsburgh, Pa.

Sayre, Frank N.,
Trainmaster,
Aliquippa & So. R. R.,
112 Orchard St.,
Aliquippa, Pa.

Schaacke, William,
Car Inspector,
Woodlawn & Southern St. Ry. Co.,
112 Ruth St.,
Pittsburgh, Pa.

Schaaf, A. J.,
750 N. W. 12th Court,
Miami, Florida.

Schaefer, Frederic,
Schaefer Equipment Co.,
Koppers Bldg.,
Pittsburgh, Pa.

Schaeffer, F. E.,
Asst. Manager of Sales,
Union Spring & Mfg. Co.,
2001 Clark Building,
Pittsburgh, Pa.

Schiller, John,
Cond'r., P. & W. Va. R. R.,
7743 Forbes St.,
Pittsburgh, Pa.

Schiller, William B., Jr.,
Secretary-Treasurer,
Standard Auto-Tite Joints Co.,
1005 Park Bldg.,
Pittsburgh, Pa.

Schmidt, E. M.,
Yardmaster,
P. & L. E. R. R.,
2732 Queensboro Ave.,
South Hills P. O.,
Pittsburgh, Pa.

Schmied, Fred J.,
Foreman,
Railway Service & Supply Corporation,
302 Russelwood Ave.,
McKees Rocks, Pa.

Schmitt, Raymond F.,
Clerk,
Mon. Con. R. R. Co.,
1714 Hatteras St.,
N. S., Pittsburgh, Pa.

Schmoll, G. A.,
Sup'vr. Loco. Maintenance,
B. & O. R. R.,
Baltimore, Md.

Schneider, G. August,
Vice President,
Rees Manufacturing Corp.,
Thomas Boulevard,
Pittsburgh, Pa.

Schneider, George,
Inspector,
Pressed Steel Car Co.,
906 Woodward Ave.,
McKees Rocks, Pa.

Scheen, W. H., Jr.,
Vice President.
Pgh. Knife & Forge Co.,
926 Farmers Bank Bldg.,
Pittsburgh, Pa.

Schrader, A. P.,
Asst. to Transportation Sales Manager,
Westinghouse Elec. & Manufacturing Co.,
150 Broadway,
New York, N. Y.

Schrecongost, C. P.,
Traffic Mgr.,
Hillman Coal & Coke Co.,
First Nat. Bank Bldg.,
Pittsburgh, Pa.

Schuchman, W. R.,
President,
Homestead Valve Mfg. Co.,
P. O. Box 442,
Homestead, Pa.

Schultz, Charles H.,
Distributor,
E. F. Houghton & Co.,
3363 Portola St.,
Pittsburgh, Pa.

Schultz, Geo. H.,
Coal Agent,
Penna. Railroad,
722 Penna. Station,
Pittsburgh, Pa.

Schultz, Harry P.,
General Yardmaster,
P. & L. E. R. R.,
2714 Fifth Avenue,
Beaver Falls, Pa.

Schlutz, O. B.,
Chemist and Engr. of Tests,
Lima Locomotive Works,
Lima, Ohio

Schwer, Leo D.,
Gang Foreman,
Penna. R. R. System,
R. F. D. No. 1,
Verona, Pa.

Scott, James C.,
Local Rep.,
American Car & Foundry Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Scott, L. M.,
Chief Dispatcher,
Montour Railroad,
Coraopolis, Pa.

Scull, Joseph W.,
Sales Representative,
Stronach Nail Co.,
Union Bank Bldg.,
Pittsburgh, Pa.

Seaman, G. W.,
Asst. Traffic Mgr.,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Searles, E. J.,
Manager,
Schafer Equipment Co.,
Koppers Bldg.,
Pittsburgh, Pa.

Seibert, Wm. L.,
Engine House Fore.,
P. & L. E. R. R.,
327 Russellwood Ave.,
McKees Rocks, Pa.

Seiss, W. C.,
Foreman Car Insp'rs.,
P. C. C. & St. L. Ry. Co.,
2786 Zephyr Ave.,
Corliss Station,
Pittsburgh, Pa.

Seley, C. A.,
Consulting Engr.,
Loco. Firebox Co.,
1908 New Straus Bldg.,
310 Michigan Ave.,
Chicago, Ill.

Semethy, Joseph J.,
Asst. Fore., Tool & Die Dept.,
Westinghouse Air Brake Co.,
Forest Hills
Wilkinsburg, Pa.

Semmer, M. R.,
Saleman,
Air Reduction Sales Co.,
1709 New Haven Ave.,
South Hills Branch,
Pittsburgh, Pa.

Seroky, E. A.,
Asst. Shipper,
Fort Pitt Malleable Iron Co.,
838 Russellwood Ave.,
McKees Rocks, Pa.

Severn, A. B.,
Sales Engineer,
A. Stucki Co.,
419 Oliver Bldg.,
Pittsburgh, Pa.

Shaddock, C. E.,
Train Dispatcher,
Aliquippa & Southern R. R.,
1309 McMinn St.,
Alliquippa, Beaver Co., Pa.

Shafer, J. S.,
Clerk, Mechanical Dept.,
Union Railroad,
325 Franklin Ave.,
Wilkinsburg, Pa.

Shannon, David E.,
Employment Agt.,
Ft. Pitt Malleable Iron Co.,
412 Grove St.,
McKees Rocks, Pa.

Shannon, Wallace R.,
Train Rules Examiner,
P. & L. E. R. R.,
3111 Pioneer Ave.,
Dormont,
Pittsburgh, Pa.

Sharp, H. W.,
Mechanical Engineer,
6619 Shetland St.,
E. E., Pittsburgh, Pa.

Sharp, James,
M. M., McKeesport Con. R. R.,
Box 297,
Homestead, Pa.

Shaw, George M.,
Representative,
Standard Steel Car Co.,
Box 248,
Baltimore, Md.

Shaw, John,
Roadmaster,
B. R. & P. Ry.,
404 Indiana St.,
Punxsutawney, Pa

Shea, D. S.,
Supt. Police,
B. R. & P. Ry.,
302 Olive Ave.,
DuBois, Pa.

Sheedy, J. A.,
Master Mechanic,
Penna. Railroad,
Wilmington, Del.

Shellenbarger, Herbert M.,
Com. Engr., W. A. B. Co.,
East McKeesport, Pa.

Shelly, DeWitt L.,
Shop Engineer,
Westinghouse Air Brake Co.,
353 Marquerite Ave.,
Wilmerding, Pa.

Shelton, F. M.,
Superintendent,
W. & L. E. R. R.,
Toledo, Ohio

Sheridan, Thos. F.,
Chief Clerk to Supt. M. P,
P. & L. E. R. R.,
Pittsburgh, Pa.

Shirey, Don. B.,
T. M., Union R. R.,
490 Marion Ave.,
Forest Hills Boro.,
Wilkinsburg Sta., Pa.

Showalter, Joseph,
Boiler Maker Foreman,
Aliquippa & Southern
R. R., 116 Carrol St.,
Aliquippa, Pa.

Shriver, W. W.,
Air Brake Instructor,
Baltimore & Ohio R. R.,
961 Oakland Ave.,
Price Hill,
Cincinnati, Ohio

Shuck, Wm. C.,
Salesman, Lockhart Iron &
Steel Company,
P. O. Box 1243,
Pittsburgh, Pa.

Shultz, G. J.,
Gang Fore., Penna. System,
1052 Berg St.,
Johnstown, Pa.

Sidey, W. J.,
Division Storekeeper,
B. R. & P. Ry.,
132 So. Brady St.,
DuBois, Pa.

Sieger, Hillard J.,
Yardmaster,
P. & L. E. R. R.,
183 St. Joseph St.,
Mt. Oliver, Pittsburgh, Pa.

Simmons, William H.,
General Foreman,
P. & L. E. R. R.,
Dawson, Pa.

Simons, Philip,
Traffic Manager,
Copperwald Steel Co.,
Glassport, Pa.

Simpkins, Fred E.,
Freight Movement Director,
Penna. R. R. System,
310 Pennsylvania Station,
Pittsburgh, Pa.

Simpson, Robert,
Piece Work Inspector,
P. & L. E. R. R.,
Newell, Pa.

Skuce, Chas. G.,
C. C. to Gen. S. M. P.,
Penna. System,
30 Linshaw Ave.,
Crafton Station,
Ingram, Pa.

Sladden, F. T.,
A. G. F. A., P. & L. E. R. R.,
Pittsburgh, Pa.

Sleeman, J. T.,
Engineman,
P. & L. E. R. R.,
3303 Francisco St.,
Corliss Station,
Pittsburgh, Pa.

Slick, Frank F.,
Asst. Gen. Supt.,
Edgar Thomson Works,
C. S. Co.,
Braddock, Pa.

Smith, C. J.,
Assistant Agent
P. & L. E. R. R.,
Market St.,
Elizabeth, Pa.

Smith, E. E.,
Gen. Passenger Agent,
P. & L. E. R. R.,
Terminal Annex Bldg.,
Pittsburgh, Pa.

Smith, E. E.,
General Manager,
Scott Haven Coal Co.,
415 Pitt St.,
Wilkinsburg, Pa.

Smith, E. W.,
Vice President,
Penna. Railroad,
909 Pennsylvania Station,
Pittsburgh, Pa

Smith, F. C.,
Chief Clerk,
P. & L. E. R. R.,
Room 132,
Pittsburgh, Pa

Smith, Frank D.,
Electric Rwy. Div.,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Smith, Frederic M.,
106 Second St.,
Ellwood City, Pa.

Smith, H. H.,
Traffic Manager,
American Sheet & Tin
Plate Co.,
Frick Bldg.,
Pittsburgh, Pa.

Smith, Homer K.,
Heavy Traction Engineer,
Westinghouse Elec. &
Mfg. Co.,
1213 La Clair Ave.,
Swissvale, Pa.

Smith, J. Frank,
Gang Foreman,
Union Railroad,
141 Brown Ave.,
Turtle Creek, Pa.

Smith, John L.,
2060 Summer St.,
Youngstown, Ohio.

Smith, M. A.,
Supt. Motive Power,
P. & L. E. R. R.,
Annex Bldg., P. & L. E.
Pittsburgh, Pa.

Smith, M. A.,
General Manager,
Edgewater Steel Co.,
Box 249,
Pittsburgh, Pa.

Smith, M. S.,
Pur. Agt. & Gen. S. K.,
Monongahela Rwy. Co.,
Brownsville, Pa.

Smith, P. F., Jr.,
Engineer of Motive Power,
P. R. R. System,
P. O. Box 534,
Paoli. Chester Co., Pa

Smith, Ralph W.,
Renewal Parts Engineer,
Westinghouse E. & M. Co.,
East Pittsburgh, Pa.

Smith Walter S.,
Gang Foreman,
P. & L. E. R. R.,
Dawson, Pa.

Smythe, Chas. T.,
Yard Master,
Mon. Con. R. R. Co.,
56 Hazlewood Ave.,
Pittsburgh. Pa.

Snodgras, Thomas R.,
Asst. Supervisor,
Mon. Con. Railroad,
3540 Second Ave.,
Pittsburgh, Pa.

Snowwhite, Thomas H.,
Surgeon,
Union Railroad Co.,
East Pittsburgh, Pa.

Snyder, C. L.,
Salesman,
Appleton Electric Co.,
376 Parkway Drive.
Mt. Lebanon District,
Pittsburgh, Pa.

Snyder, F. I.,
Vice Pres. & General Mgr.,
B. & L. E. R. R. Co.,
Box 456,
Pittsburgh, Pa.

Snyder, H. A.,
Salesman,
American Hoist & Derrick
Company,
Farmers Bank Bldg.,
Pittsburgh, Pa.

Snyder, J. A.,
Chief Inspector,
Hartford Steam Boiler
Inspection & Insurance Co.,
Arrott Bldg.,
Pittsburgh, Pa.

Snyder, P. McK.,
Div. Passenger Agt.,
B. R. & P. Ry. Co.,
1927 Morell St.,
N. S., Pittsburgh, P.a

Snyder, Samuel, Jr.,
Gang Fore., Car Dept.,
Union Railroad Co.,
North Bessemer, Pa.

Souders, W. J.,
Route Agent,
American Railway Express
Company,
144 W. Long Ave.,
DuBois, Pa.

Sparks, Hynes,
The Symington Co.,
250 Park Ave.,
New York City.

Spindler, Wm. E.,
Traveling Car Inspector,
P. & L. E. R. R.,
McKeesport, Pa.

Spinning, Charles F.
335 Fifth Ave.,
Pittsburgh, Pa.

Sproull, C. W.,
Mechanical Engineer,
Union Switch & Signal Co.,
113 Washington St.,
Edgewood,
Pittsburgh, Pa.

Stackhouse, R. K.,
Gen. Supt. Stations, Transfers
and Motor Service,
Penna. R. R.,
504 Broad St. Station.
Philadelphia, Pa.

Stafford, Saml. G.,
President,
Vulcan Crucible Steel Co.,
Aliquippa, Pa.

Stamets, Wm. K.,
4026 Jenkins Arcade,
Pittsburgh, Pa.

Stamm, B. B.,
Draftsman,
Standard Steel Car Co.,
510 McKinley Ave.,
Butler, Pa.

Stanford, E. R.,
Service Engineer,
The Superheater Co.,
15 Dorchester Road,
Buffalo, N. Y.

Stanyard, C. S.,
Ticket Agent,
P. & L. E. R. R.,
McKeesport, Pa.

Stark, F. H.,
Retired,
702 Main St.,
Coraopolis, Pa.

Stearns, Kenneth R.,
Railway Engineer,
Westinghouse E. & M. Co.,
415 Lamar St.,
Wilkinsburg, Pa.

Stebler, W. J.,
Vice President,
Conley Tank Car Co.,
Oliver Building,
Pittsburgh, Pa.

Steele, I. H.,
C. C. to F. C. Agent,
P. & L. E. R. R.,
155 Ulysses St.,
Mt. Washington, Sta.,
Pittsburgh, Pa.

Steigerwalt, Robert W.,
Inspecting Engineer,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Stephensky, Jules,
Air Brake Inspector,
Union Railroad,
R. D. 1,
Turtle Creek, Pa

Sterling, C. C.,
Engine House Fore.,
Union R. R.,
339 Albert St.,
Turtle Creek, Pa.

Stevens, L. V.,
President,
Marine Mfg. & Supply Co.,
35 Water St.,
Pittsburgh, Pa.

Stevens, R. R.,
Draft Gear Engineer,
Westinghouse Friction
Draft Gear Co.,
5 Elmore Road,
Wilkinsburg, Pa.

Stevenson, Richard,
Storekeeper,
P. & L. E. R. R.,
Newell, Pa.

Stewart, L. R.,
Asst. R. F. of E.,
Pennsylvania Railroad,
868 W. Exchange St.,
Akron, Ohio.

Stewart, W. W.,
Sales Manager,
Koppel Industrial Car &
Equipment Co.,
1901 Farmers Bank Bldg.,
Pittsburgh, Pa.

Stiles, Lawson, A.,
Baggage Agent,
P. & L. E. R. R.,
P. & L. E. Terminal,
Pittsburgh, Pa.

Stilwell, K. E.,
Service Engr.,
The Superheater Co.,
1215 W. Water St.,
Elmira, N. Y.

Stine, D. H.,
Asst. R. F. of E.,
Penna. R. R. System,
(Allegheny Shops),
N. S., Pittsburgh, Pa.

Stiver, Joseph R.,
Conductor,
B. R. & P. Ry.,
126 Ridge Ave.,
Punxsutawney, Pa

Stoecker, P. J.
Pittsburgh Steel Co.,
Union Trust Bldg.,
Pittsburgh, Pa.

Stoehr, Arthur L.,
Gang Fore., Car Dept.
Union Railroad Co.,
Unity, Pa.

Stoffregen, Louis E.,
Draftsman,
P. & L. E. R. R.,
213 Grandview Ave.,
Mt. Washington,
Pittsburgh, Pa.

Stokes, A. H.,
Asst. Superintendent,
B. R. & P. Ry.,
111 Belmont Ave.,
Punxsutawney, Pa.

Stone, W. A.,
Freight Agent,
P. & L. E. R. R.,
P. & L. E. Freight Office,
New Castle, Pa.

Stonick, A. E.,
Y. M. Union R. R.,
1308 Franklin Ave.,
Wilkinsburg, Pa.

Stonick, E. A.,
G. Y. M., Carnegie Steel Co.,
15 Kemper St.,
Pittsburgh, Pa.

Storer, N. W.,
Consulting Rwy. Engineer,
Westinghouse Elec. &
Manufacturing Co.,
East Pittsburgh, Pa.

Stoughton, S. J.,
General Manager,
Pittsburgh Cleanser
Laboratory,
1216 Metropolitan St.,
N. S., Pittsburgh, Pa.

Strachan, M. B.,
Y. M., Mon. Con. R. R. Co.,
2805 Strachan Ave.,
Dormont, Pgh., Pa.

Stritzinger, Frank
Wheel Insp'r., P.&L.E.R.R.,
117 Stem St.,
Wabash Station,
Pittsburgh, Pa.

Strohmer, John L.,
Service Engr., Franklin
Rwy. Supply Co.,
Calverton Apts.,
Calvert & 25th Sts.,
Baltimore, Md.

Strommen, Theo. A.,
Electrical Engineer,
Westinghouse E. & M. Co.,
828 Maple Ave.,
Turtle Creek, Pa.

Stucki, A.,
Engineer,
419 Oliver Bldg.,
Pittsburgh, Pa.

Stuebing, A. F.,
Chief Engineer,
The Bradford Corp'n.,
25 West 43rd St.,
New York, N. Y.

Stump, O. C.,
Asst. Engine House Fore.,
Penna. R. R. System,
427 Vermont Ave..
Rochester, Pa.

Suckfield, G. A.,
Asst. Chief Engr., F. C. D.,
Pressed Steel Car Co.,
McKees Rocks, Pa

Sullivan, M. J.,
Inspector of Stores,
P. & L. E. R. R.,
43 Highland Ave.,
McKees Rocks, Pa.

Sutherland, Lloyd,
Gen. Storekeeper,
P. & L. E. R. R.,
124 Greydon Ave.,
McKees Rocks, Pa

Suydam, R. S.,
President,
M. B. Suydam Co.,
Island & Preble Aves.,
N. S., Pittsburgh, Pa.

Swanson, Carl A.,
C. C. to Gen. Mgr.,
P. & L. E. R. R.,
468 Irvin Ave.,
Rochester, Pa.

Swenk, Raymond,
Supt., E. & A. Div.,
P. R. R. System,
New Castle, Pa

Sykes, Arthur H.,
Safety Agent,
P. & L. E. R. R.,
707 Florida Ave.,
Mt. Lebanon,
Pittsburgh, Pa.

Sylvester, H. G.,
Mgr. Central Warehouse,
P. & L. E. R. R.,
Pittsburgh, Pa.

Symons, F. E.,
President,
The Ralston Steel Car Co.,
Columbus, Ohio

Taiclet, John A.,
Gang Foreman,
Penna. R. R. System,
1102 Morrison Ave.,
N. S., Pittsburgh, Pa.

Tarr, H. S.,
Foreman,
Union Railroad,
413 Franklin Ave.,
Wilkinsburg, Pa.

Tate, James B.,
Purchasing Agent,
Pressed Steel Car Co.,
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Pittsburgh, Pa.

Tate, R. G.,
G. Y. M., B. R. & P. Ry.,
214 Ridge Ave.,
Punxsutawney, Pa.

Tate, Ralph H.,
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Pittsburgh, Pa.

Taylor, Clifton,
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America,
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Pittsburgh, Pa.

Taylor, E. P.,
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235 Front St.,
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Taylor, H. G.,
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Fulton Building,
Pittsburgh, Pa.

Taylor, Joseph M.,
Sales Dept., Ball Chemical Co.,
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Taylor, Leonard C. G.,
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Penna. Railroad,
1901 Marmaduke St.,
N. S., Pittsburgh, Pa

Taylor, W. H.,
Vice Pres., Nat. Lead & Oil
Co. of Penna.,
316 Fourth Ave.,
Pittsburgh, Pa

Teckemeyer, J. Fred,
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Temple, H. H.,
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441 Wabash Bldg.,
Pittsburgh, Pa.

Terrill, Elmer, F.,
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Gen. Contracting Corp. of Pittsburgh,
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St. Albans, W. Va.

Thiele, Fred, Sr.,
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Thomas, F. A.,
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Pittsburgh, Pa.

Thomas, Frank B.,
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536 Trenton Ave.,
Wilkinsburg, Pa.

Thomas, Harrison M.,
Moore, Leonard & Lynch,
Union Trust Building,
Pittsburgh, Pa.

Thompson, F. J.,
Terminal Supt.,
B. R. & P. Ry.,
221 E. Lincoln Ave.,
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Thompson, Homer D.,
Air Brake Inspector,
Union Railroad,
Box 105,
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Tipton, George M.,
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Braddock, Pa.

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Aliquippa & Southern R. R.,
163 Spring St.,
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Toucceda, Prof. Enrique,
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943
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433 Broadway,
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1902 McMinn St.,
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920 Second St.,
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329 E. Brady St.,
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Service Engineer,
Franklin Rwy. Supply Co.,
1105 Biltmore Ave.,
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Winwood, Horatio M.,
Locomotive Engineer,
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1400 Pocono St.,
Swissvale, Pa.

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188 Kenmore Ave.,
Youngstown, Ohio

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1404 Monterey St.,
N. S., Pittsburgh, Pa.

Woods, Joseph,
Statistician,
P. & L. E. R. R.,
5124 Baum Blvd.,
Pittsburgh, Pa.

Woodward, Robert,
Machinist, P. R. R. System,
314 George St.,
Turtle Creek, Pa.

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Publisher,
Rwy. Purchases & Stores,
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Pittsburgh, Pa.

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Fort Pit Malleable Iron Co.,
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Pittsburgh, Pa.

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Wright, O. L.,
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The Duff-Norton Mfg. Co.,
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Wright, R. V.,
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Railway Age
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New York, N. Y.

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East Pittsburgh, Pa.

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Train Dispatcher,
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609 Owens St.,
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Zammikiel, John,
Clerk,
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413 Boyd St.,
Turtle Creek, Pa.

Zentgraft. Henry,
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B. R. & P. Ry.,
11 Mt. Troy Road,
N. S., Pittsburgh, Pa.

Zilian, Ralph F.,
Engine House Foreman,
Penna. Railroad,
1336 Pennsylvania Ave.,
N. S., Pittsburgh, Pa

Zimmerlink, Martin,
Yardmaster,
P. & L. E. R. R.,
409 Erie Street,
McKeesport, Pa.

Zirckel, Arthur H.,
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WILLIAM J. GILLESPIE
DIED MAY, 28, 1929

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Of Official Proceedings—Railway Club of Pittsburgh, published Monthly, except June, July and August, at Pittsburgh, Pa., for October 1, 1929.

STATE OF PENNSYLVANIA } ss:
COUNTY OF ALLEGHENY }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

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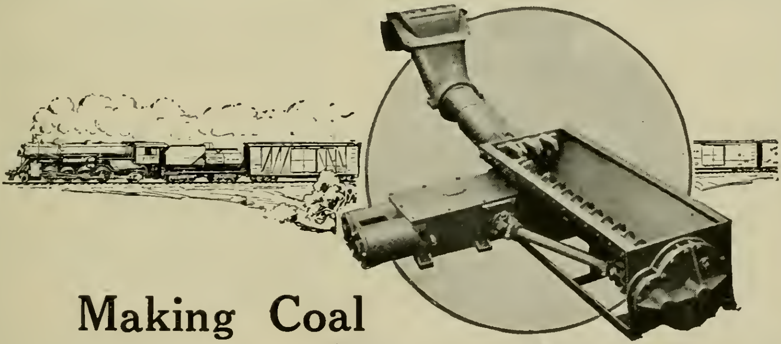

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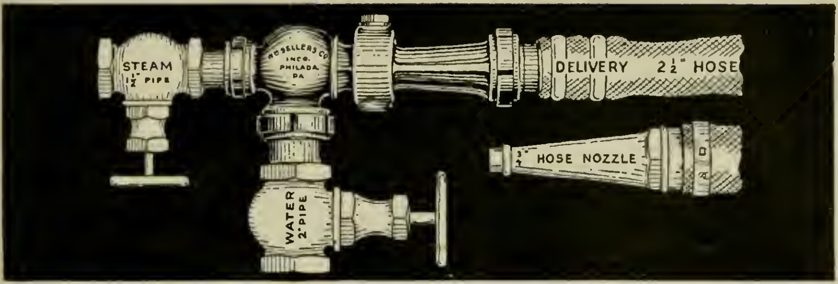

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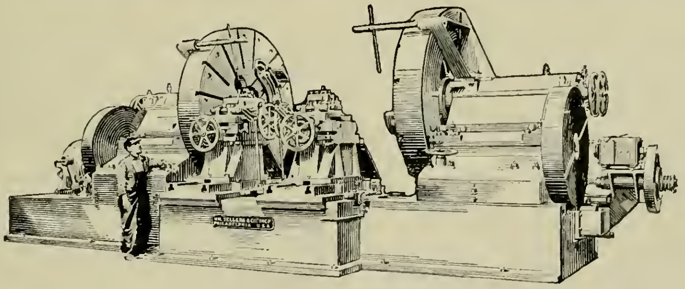
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